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WORK PLAN
ORTHO-CHEVRON CHEMICAL PLANT
MARYLAND HEIGHTS, MISSOURI

WOODWARD-CLYDE CONSULTANTS
5055 Antioch Road
Overland Park, Kansas 66203
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WCC Project 13C114-19

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Superfund

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1.0 INTRODUCTION

The U.S. Environmental Protection Agency (USEPA) has requested Chevron Chemical Company and its consultant, Woodward-Clyde Consultants, to submit a Work Plan addressing certain past waste management practices at Chevron Chemical Company's facility in Maryland Heights, Missouri. Chevron Chemical Company and Woodward-Clyde have developed this Work Plan to address and guide the proposed field and office studies at the Maryland Heights, Missouri facility.

Planned field activities include the installation of off-site ground water monitoring wells, shallow soil sampling, and on-site and off-site ground water sampling and analyses. The data obtained from these activities will aid in refining the characterization of the site. The refinement of the site characterization will be utilized in the various assessments necessary to assess the need for and to select appropriate and cost effective remedial responses. Raw data collected during the implementation of this Work Plan will be supplied to EPA.

The objectives and scope of each component of this investigation are presented in the corresponding sections of the Work Plan.

1.1 NATURE OF PROBLEM

On June 4, 1981, and December 7, 1981, Chevron Chemical Company filed notifications with the United States Environmental Protection Agency (USEPA) which identified areas at their Maryland Heights plant where past disposal of potentially hazardous waste was suspected. The two primary suspected disposals consisted of the burial of debris from a plant fire which occurred in 1952 and the burial of a quantity (2000 to 4800 pounds) of bagged Maneb (manganese ethylenebis (dithiocarbamate) Cas No. 12427-38-2) fungicide which occurred in 1974. Pesticides have been detected in shallow soils and in ground water on-site during investigations by Woodward-Clyde

Consultants which were instituted by the Chevron Chemical Company in 1981. Reports summarizing these investigations are described in Section 2.2 and in Appendix 1.

1.2 PLAN DEVELOPMENT

Specific plans are being developed for the operations corresponding to the components of this Work Plan. A Health and Safety Plan has been prepared which covers health and safety protocol to be observed during field work proposed in this Work Plan and is presented in Appendix 2.

A Sampling Plan for the proposed field activities is presented in Appendix 3. The sampling plan covers procedural aspects of the various field activities.

A Quality Assurance/Quality Control (QA/QC) plan is presented in Appendix 4. The QA/QC plan covers aspects of the quality assurance and quality control which relate to field and laboratory procedures, validation of data, analytical laboratory use, and documentation.

1.3 SCHEDULE

The proposed tasks presented in this Work Plan are scheduled to be implemented over a period of fifteen (15) months. The estimated schedule for implementation of this Work Plan is presented in Section 8.0. This schedule also shows decision points where EPA will be briefed on the progress of work to date, allowing for Chevron/EPA interaction.

2.0 SITE DESCRIPTION AND BACKGROUND

2.1 DESCRIPTION OF SITE AND VICINITY

The Ortho-Chevron Agricultural Plant is located in an established industrial area along Adie road in Maryland Heights, Missouri. The property is approximately 15 miles west of the greater St. Louis area in the southwest quarter of Section 23, Township 46 North, Range 5 East (Figures 1 and 2). The site lies within the Fee Fee Creek watershed which ultimately drains into the Missouri River 5 miles to the northwest. The site is rectangular (approximately 1300 feet by 325 feet) with the long axis oriented east-west (Figure 3). Plant facilities include office buildings, storage tanks, and two series of production buildings located adjacent to two rail spurs (Figure 4). A small storm water retention and spill containment pond is located near the northwest corner of the site.

2.2 REVIEW OF EXISTING DATA

2.2.1 PREVIOUSLY REPORTED DATA

In 1981, Chevron Chemical Company initiated geohydrological investigations at the Maryland Heights site. Soil and ground water monitoring activities have also been implemented. Investigations have included installation and sampling of ground water monitoring wells, exploratory borings, and shallow soil borings. Monitoring and investigative activities to date at the site include:

- 1978 - Building extension subsurface geotechnical investigation
- 1981 - Geohydrological investigation and evaluation
 - 34 exploratory borings drilled
 - 15 observation wells installed
 - Geotechnical and chemical soil analyses
 - Ground water analyses
 - Field permeability tests
 - Off-site drinking water well survey

- 1983 - Installation and sampling of 6 additional ground water monitoring wells
 - Soil sampling and analysis on east and west boundaries
- 1984 - Updated off-site drinking water well survey
- 1985 - Soil chemistry investigation along on-site railroad spur
 - Soil sampling and analysis for 2,3,7,8-TCDD (dioxin)
 - Building 'D' extension subsurface geotechnical investigation
- 1986 - Surface water survey conducted
- 1981 to present - Ongoing semi-annual or quarterly ground water sampling and analyses

Most activities have been reported and/or referenced in the June 1986, Site Characterization Report. Those which have not previously been reported are presented in the following section (2.2.2) and Appendix 1.

Information from on-site borings indicate that the subsurface conditions generally consist of loess overlying clay and weathered shale which overlies limestone. Generalized cross sections depicting subsurface conditions along the north edge of the site are referenced on Figure 3 and presented in Figures 7 and 8.

2.2.2 OTHER INVESTIGATIONS

2.2.2.1 Subsurface Investigations

On December 15, 1978 six borings were made for an investigation into the engineering properties of subsurface materials for a proposed expansion of the maintenance shop and Building E. Locations and records for these borings, as well as a summary of the engineering properties and observations of the subsurface materials, are included in Appendix 1.

In 1985, a building expansion was proposed which is located just west of the north loading dock. A drilling program was conducted to look for

buried fire debris in the expansion area. Ninety-six probes on 10-foot centers were drilled to depths down to a maximum of approximately 10 feet. Based on principles of geostatistics, the spacing provided a 75% probability of encountering a trench, if one existed. Some fragments of glass, some white powder, steel wool, and some charred wood debris were found, but the overall conclusion was that trench disposal of fire debris had most likely not occurred in this area. A summary of the results of this investigation is presented in Appendix 1.

2.2.2.2 Potential Contaminant Source Removals

Removal or control of potential contaminant sources has been performed at the plant. All underground pipelines have been removed. Most of the surface area on-site has been paved and spill containment structures have been placed around the tank farm.

In 1975 or 1976, an oil skimmer pit and sand filter were removed. They had been located near the present retention pond (Figure 5). This may be what has been referred to as an evaporation pond. The overflow pit is thought to have been a temporary holding pit for oil during periods of high runoff.

The skimmer was steam cleaned, backfilled, and left in place. The filter sand and the clay from the pit were removed and disposed of as hazardous waste. The skimmer pit consisted of a concrete box with surface wiers to segregate and collect oil from storm water. The floating oil was removed by a hazardous waste disposer and the outfall water went to the storm water retention pond. During times of heavy runoff, a pit would be dug next to the skimmer to provide additional capacity. This would be emptied by the hazardous waste disposer. During closure of this feature no samples of the filter or the surrounding soil were taken. However, it is currently included in the area where soil samples will be obtained under this Work Plan.

In the summer of 1986, the central railroad spur was extended (Figure 4). During this construction, material which appeared to be fire debris was uncovered. Approximately 662 cubic yards of this material was excavated and disposed of as hazardous waste. Of this 662 cubic yards, it is believed by Chevron that 250 cubic yards were actual fire debris. Figure 5 shows the extent of this excavation material and the probable location of any remaining fire debris. Chemical analyses from a sample of this material are presented in Appendix 1.

2.2.2.3 Additional Investigations

Additional investigations not previously discussed have also been carried out on-site and are briefly described in Appendix 1. These include sampling an abandoned storm water sewer in February 1987, drainage ditch and seep sampling in March 1987 and sampling fill soils for chemical analyses in October 1986.

3.0 PROPOSED FIELD INVESTIGATION

Field investigations are proposed which will aid in the characterization of ground water flow direction in the limestone bedrock, ground water quality, soil contamination, and migration of contaminants. The scheduled field events include shallow soil sampling on- and off-site (Sections 3.2.1 and 3.2.3), off-site monitoring well installations and sampling (Sections 3.2.1 and 3.2.2), and the continuation of on-site quarterly ground water sampling (Section 3.2.3) which was implemented in 1981. On-site ground water monitoring is necessary to characterize the migration (vs. time) of contaminants which have been detected. Off-site ground water monitoring will aid in defining the lateral and vertical extent of migration of contaminants. The need for monitoring of the unsaturated zone will be evaluated after the on-site shallow soil sampling has been completed.

The site and immediate vicinity will be assessed for the effectiveness of a surface geophysical survey. The objective of the geophysical survey is to identify shallow locations of buried materials in the western portion of the site and to characterize the extent of shallow ground water contamination.

A surface geophysical survey may not be effective because of the many local interfering structures (i.e., fences, buildings, utilities, etc.).

3.1 ON-SITE ACTIVITIES

The following sections present proposed on-site activities. Two field tasks are scheduled at this time. Chevron is continuing quarterly ground water monitoring and also will perform a shallow soil investigation at the far west end of the site. This investigation will consist of several borings from which samples will be analyzed for potential subsurface contamination.

3.1.1 GROUND WATER SAMPLING

3.1.1.1 Objectives and Scope

Monitoring wells (OWC-) 1, 12A, 14, 15, 16, 17, 18, 19 and 20 will be sampled and analyzed on a quarterly basis for the time period covered by this Work Plan. These monitoring wells have been sampled regularly because they represent locations upgradient (background) or the most downgradient (on-site) possible within the contaminated zone and were selected for monitoring because of their locations on-site. These wells represent the area of contamination or the area immediately downgradient of the contaminated zone based on ground water flow direction. It was felt these wells would supply the required information for delineation of the contaminant plume. Samples from wells will be analyzed for xylenes, arsenic, and selected pesticides (Table 1). These analyses will be used in evaluating migration of contaminants in the site area.

TABLE 1
COMPOUNDS ANALYZED FOR
IN GROUND WATER MONITORING PROGRAM

<u>Volatile Organics</u>	<u>Pesticides (Herbicides)</u>	<u>Pesticides (Insecticides)</u>	<u>Metals</u>	<u>Field Measurements</u>
Total Xylenes	2,4-D 2,4,5-T	4,4-DDT 4,4-DDE 4,4-DDD Aldrin Dieldrin Chlordane Heptachlor Lindane Endrin Toxaphene	Arsenic	pH Specific Conductance Temperature

3.1.1.2 Technical Approach

The procedures for ground water sampling are detailed in the Sampling Plan presented in Appendix 3. Generally, water levels will be measured prior to sampling to aid in the mapping of piezometric surface. The well will then be purged so that a representative sample of the ground water may be obtained. Once samples are obtained, they will be preserved (per USEPA Region VII guidance) and shipped under chain-of-custody to Wilson Laboratories in Salina, Kansas. Documentation and decontamination efforts to be performed during sampling are identified in the Sampling Plan.

3.1.2 SHALLOW SOIL SAMPLING

3.1.2.1 Objective and Scope

A shallow subsurface investigation will be initiated in the western portion of the site. Information obtained from interviewing past and present personnel indicate that past disposal of Maneb fungicide may have occurred in this area. The objective of this investigation will be to evaluate the extent and concentration levels of buried Maneb fungicide in this area. Possible excavation will be based on evaluation of the soil sample analyses. Figure 9 shows the suspected area of Maneb burial and the area proposed for soil sampling. Because of the lack of historical documentation on burial and waste disposal at the western portion of the site, all areas not currently covered (asphalt, concrete; etc.) will be included in the soil sampling effort. The soil samples will be analyzed for Maneb, its primary degradation product, (ethylenethiourea) and the compounds listed in Table 1.

If Maneb and/or its primary degradation product are not found, it will be assumed that they are no longer present and, therefore, do not present a danger to human health or the environment. If concentrations of these

compounds are discovered, further action or inaction will be proposed and discussed with EPA.

3.1.2.2 Technical Approach

The procedures for soil sampling are detailed in the Sampling Plan (Appendix 3), along with associated documentation and decontamination procedures.

Information has been obtained from interviews of past and present plant personnel. Based on this information, a grid will be set up over the area of suspected Maneb contamination. From present information, it is estimated that borings will be located on 10 foot centers and will be drilled and sampled to a depth of 6 feet in the area designated as the probable Maneb burial locations. The need for additional or deeper borings within this area will be evaluated based on the analytical results from these samples. Boring spacing for other on-site soil sampling areas will be approximately 40 feet.

Samples will be shipped under Chain-of-Custody to Wilson Laboratories in Salina, Kansas. Analytical parameters for these samples will include Maneb and its primary degradation product (ethylenethiourea) along with the parameters identified in Table 1.

3.2 OFF-SITE ACTIVITIES

Off-site investigations are proposed which will aid in the evaluation of potential off-site migration of contamination. These include the off-site well survey, the installation of one shallow and one bedrock ground water monitoring well at two locations (Section 3.2.2.2), sampling of these wells at times corresponding with the proposed quarterly sampling (Section 3.2.3), and shallow soil sampling (Section 3.2.4).

It is not anticipated that access to off-site properties will result in any substantial delay in field activities. However, if property access should become a problem and substantially delay scheduled field activities EPA will be notified immediately and the revised Work Plan schedule discussed.

3.2.1 OFF-SITE WELL SURVEY

An off-site well survey will be conducted in the vicinity of the site. The objective of this survey is to locate water wells that are situated within three miles down gradient of the site. Any wells that are located will be checked for water level, total depth, and casing size if possible. Well construction will be checked against well records on file at the Missouri Department of Natural Resources, Division of Geology and Land Survey (MDNR-DGLS) at Rolla, Missouri. Water levels will be utilized in confirming the direction of ground water flow in the limestone bedrock and in locating the second off-site monitoring well cluster. All off-site wells will be evaluated for their potential use in the characterization of off-site contamination. If appropriate, they will be included in the ground water sampling program.

3.2.2 DRILLING AND WELL INSTALLATION

3.2.2.1 Objective and Scope

Installation of the proposed monitoring wells will provide information on the stratigraphy, confirm bedrock ground water flow direction in the vicinity of the site, and allow access to obtain ground water samples for analyses. This data will be used in the evaluation of potential off-site migration of contaminants.

The samples from off-site wells will be analyzed for chemical constituents shown in Table 1.

3.2.2.2 Locations

Presently, the proposed off-site monitoring well cluster location (Figure 9) appears to be down gradient of the site. It consists of one pair of nested wells, one in the shallow soils, one in bedrock. OWC-24 as proposed will be screened in the shallow water bearing unit and OWC-25 as proposed will be screened in the upper limestone.

The location of the second off-site monitoring well cluster (OWC-26,27) will be based on the evaluation of the off-site well survey and the comments of the EPA. The need for the installation of additional wells at other locations will be evaluated as appropriate.

3.2.2.3 Technical Approach

Drilling procedures, sampling procedures, documentation and decontamination are detailed in the Sampling Plan (Appendix 3). The depth of these wells have been estimated, from borings on-site, to be approximately 30 feet (soil) and 60 feet (bedrock) deep. Continuous flight hollow stem augers (8-inch diameter) will be used to drill through soils. In the deep wells, the shallow soils will be cased off before coring the limestone bedrock. HX size double tube core barrel will be used to core limestone. PVC casing and screen will be installed in each well.

Slug tests will be performed in all new wells to evaluate the effectiveness of the well and to aid in the hydrologic characterization of the site.

Geophysical logs (short and long normal resistivity) will be run from surface to total depth in the deep monitoring well at every new location. These logs will aid in characterizing the lithology, porosity, and pore fluids.

3.2.3 GROUND WATER SAMPLING

The off-site wells which are proposed to be installed will be sampled as stated in the following sections. The frequency of sampling will correspond with the quarterly sampling of on-site wells (Section 3.1.1.1). Parameters to be analyzed are presented in Table 1.

3.2.3.1 Objectives and Scope

The proposed off-site wells, OWC-24, OWC-25, OWC-26 and OWC-27 will be included in the quarterly samplings. A verification sampling and analysis will be performed approximately two (2) weeks after the initial sampling event at these wells. These samples will be analyzed for the parameters in Table 1. The appropriateness of long-term sampling of these wells will be evaluated when data is received from the implementation of this Work Plan.

3.2.3.2 Technical Approach

The approach used to sample and analyze these off-site wells will be similar to that for the on-site wells (see Section 3.1.1.2).

3.2.4 SHALLOW SOIL SAMPLING

3.2.4.1 Objectives and Scope

If the area is accessible, and access permission can be obtained, six shallow soil borings will be drilled off-site north of the northern most railroad spur (Figure 9). The locations of these borings may be modified slightly due to accessibility and additional historical data. The depth of these borings will be approximately 6 feet. Samples from these borings will be analyzed for the parameters listed in Table 1 with emphasis on arsenic in order to evaluate the possibility of wind blown or surface water born migration of arsenic from the old off-loading area adjacent to the rail spur.

3.2.4.2 Technical Approach

The approach used to sample and analyze these off-site borings will be similar to that for the on-site shallow soil sampling in the probable burial area (see Section 3.1.2.2).

4.0 DATA MANAGEMENT

4.1 LABORATORY TESTING

The laboratory which will perform the specific analytical tests on the soil and ground water samples obtained during the course of the proposed work is Wilson Laboratories in Salina, Kansas. All analyses will be performed in accordance with standard EPA methods. Specific analytical methods are presented in the QA/QC Plan in Appendix 4.

4.2 INTERPRETATION AND EVALUATION OF DATA

An interpretation and evaluation will be made of the data developed during the implementation of this Work Plan together with data obtained through previous investigations. These evaluations will be utilized in the assessment of potential endangerment and the potential remedial responses which may be considered appropriate. A characterization of the contamination will be developed including parameters of concern, concentrations and locations both on- and off-site, the potential pathways of off-site migration of these contaminants, and the evaluation of potential risk to receptors.

5.0 INTERIM POTENTIAL MITIGATION MEASURES

5.1 TARGETED REMOVALS

Based on information obtained from past and present plant employees, shallow burial of fire debris and Maneb fungicide have occurred. Leaks and/or spills of pesticides and carrier products have also occurred.

The location of a portion of the debris from the fire which occurred in 1952 was discovered recently (1986), when the central railroad spur was extended (Figure 5). Fire debris encountered during the rail spur extension was removed and disposed of properly.

An investigation will be conducted to evaluate the potential for buried Maneb fungicide in the western portion of the site. Possible excavation will be based on evaluation of the soil sample analyses. Section 3.1.2 presents this investigation as a primary component of this Work Plan.

Excavation of buried waste material and off-site disposal at an approved hazardous disposal facility is the alternative being utilized for these materials which are identified and removed.

5.2 SURFACE WATER INFILTRATION CONTROLS

Percolation of precipitation through the soil in unpaved areas of the site may result in leaching of contaminants from the soil or buried wastes. Water which infiltrates is capable of transporting contaminants from near the surface to greater depths within the soil column. Most of the area of the Ortho-Chevron site presently is paved. Surface water runoff on the site drains to the retention pond or to the drainage ditch, which ultimately empties the retention pond (Figure 6).

The need for any additional surface water controls, which may be indicated hydrogeologically and which are consistent with operating plans and future expansion plans, will be assessed after the data obtained from the analysis of the shallow soil samples are evaluated and the extent of any contaminated soil is established.

5.3 GROUND WATER PUMPING

Ground water extraction by pumping may be used to lower the ground water table, thus (1) limiting ground water/waste contact, (2) limiting the off-site migration of contaminants, (3) reducing the vertical gradient and limiting contamination of lower aquifers, and (4) reducing potential for discharge to surface water, and (5) recovery of concentrated contaminants.

An assessment will be made on the use of a recovery system in extracting xylenes/kerosenes from the ground water. Well OWC-11, in which a layer (less than 3/4 inch) of hydrocarbons was observed during the July and October 1982 sampling events, was inadvertently destroyed during the construction of the present buildings. During the August and November 1986 quarterly ground water sampling events, wells in the vicinity of OWC-11 were checked for a layer of floating xylenes or kerosene. Wells OWC-6, OWC-7, OWC-8, OWC-13, OWC-17, and OWC-19 were tested for floating hydrocarbons using an oil-water interface probe. No distinct layers were observed in any of these wells.

If the presence of floating contaminants is indicated by observation or by analyses, the effectiveness of a recovery system will be evaluated and, if found to be appropriate, implemented. The fluids extracted will be sampled, analyzed for the parameters outlined in Table 1, and disposed of accordingly. If these fluids do not exceed limits set by the St. Louis Metropolitan Sanitary District, they will be metered into the sanitary system.

If the need for long term ground water pumping or pumping and treatment is established, appropriate responses will be evaluated.

6.0 ENDANGERMENT ASSESSMENT

6.1 SITE SOURCE CHARACTERIZATION

Characterization of the site, physically (geologic, hydrologic) and with respect to sources of contamination is required prior to conducting an endangerment assessment of this site. Section 3 of this Work Plan outlines the methods to be utilized in order to obtain the data necessary to refine the site and source characterization. This new information will be used to augment that presented in the June, 1986 Site Characterization Report.

6.2 CHEMICAL CHARACTERIZATION

Characterization of the chemical constituents of concern provide necessary input to direct the endangerment assessment of the site. The chemical constituents of present concern are arsenic, lindane, aldrin, dieldrin, 2,4-D, 2,4,5-T, and xylenes. These have been chosen because of their detected levels on site. Concentration levels of these and other chemical compounds are presented in the Site Characterization Report.

6.3 PATHWAYS CHARACTERIZATION

It is necessary to define the potential pathways of migration, both vertically and horizontally, before risks to a receptor can be evaluated. The results of the surface water survey (Site Characterization Report) show that the primary pathway to receptors is through the ground water since surface water route to the Missouri River is primarily through industrial/-commercial areas. The ground water pathway will be characterized in two separate components, ground water which remains in the subsurface which could migrate to a drinking water well contact and shallow ground water which could seep or drain into surface water bodies. The potential for vertical migration of contaminants into the bedrock will be evaluated when data from the off-site wells are obtained.

6.4 RECEPTOR EVALUATION

An evaluation will be conducted of potential receptors in possible contact with the primary pathways of potential contaminant migration. Two types of receptors will be included in the evaluation: drinking water well locations and surface water bodies.

A preliminary investigation into ground water receptors was initiated in 1981 and reported in the 1981 Preliminary Site Evaluation Report. This preliminary investigation was expanded in 1984 to include locations of water wells within three miles of the site. During the course of the studies covered by this Work Plan, it is proposed that these wells be located in the field or their abandonment be documented where possible. It is also proposed that water levels be checked in wells which are located. The need for sampling and analysis of each located well will be evaluated.

The information obtained from these studies will be analyzed for use in the evaluation of location specific risks. Applicable data regarding Acceptable Daily Intakes (ADI) will be used in establishing Alternate Concentration Limits (ACL) if appropriate. Where available, ADI's utilized in this assessment will be those values established by USEPA. Other values necessary to complete the assessment will be requested from the Agency for Toxic Substances and Disease Registry (ATSDR) through USEPA.

6.5 ENDANGERMENT EVALUATION

An assessment of endangerment to receptors will be conducted which considers the nearest potential receptors for each primary pathway of potential contaminant transport. As stated in Section 6.4, this will include drinking water wells (ground water pathway).

Available standards and criteria will be used in the evaluation of endangerment for certain compounds where they exist. If the evaluation shows

that risk to human health or the environment exists, a cost effective remedial action will be evaluated (Section 7.0) and proposed.

7.0 EVALUATION AND NEED FOR IMPLEMENTATION OF POTENTIAL REMEDIAL RESPONSES

7.1 INTRODUCTION

A variety of engineering technologies have been developed or are currently under development for use in environmental engineering applications for remediation of contaminated ground water and soil. We will evaluate several of these technologies for their suitability and potential application at the Maryland Heights plant site. A series of alternative remedial responses will be identified which may consist of combinations of the technologies considered applicable for the site. Alternatives which will be considered include the following:

- o continued monitoring,
- o targeted removals,
- o surface water infiltration controls,
- o ground water pumping and treatment, and
- o limited action utilizing alternate concentration limits (ACL's) as guidelines.

A brief description of the approach for evaluating each of these alternatives follows. An approach to an ACL demonstration is provided in Section 7.4.

7.2 CONTINUED MONITORING

Ground water investigations were initiated at the site in 1981. These investigations included installation and sampling of ground water monitoring wells, exploratory borings, and shallow borings. Quarterly ground water monitoring of the site, consisting of ground water sampling and analyses, continue to be performed. Characterizations of on-site soils and ground water have been developed based on data obtained to date. Evaluations are made of trends in these data as new information becomes available.

Guidelines may be established where specific actions may be implemented if certain levels are exceeded in the ongoing monitoring program.

7.3 LONG TERM POTENTIAL REMEDIAL RESPONSES

Since detectable levels of contaminants have been observed in ground water samples on-site, it is possible that long term remedial measures may need to be implemented at some time. This section presents some of the potential long term remedial responses which may be evaluated for implementation at the site.

7.3.1 TARGETED REMOVALS

Based on data obtained from the shallow boring, chemical analyses program, specific areas on-site may be targeted for excavation and removal. This would involve removing contaminated soils from the site and disposal in an approval hazardous waste disposal facility. Following excavation, the excavated area would be backfilled, graded, and revegetated and the land made available for future development as per Chevron's needs.

7.3.2 SURFACE WATER INFILTRATION CONTROLS

Surface water infiltration may be controlled by further capping areas on-site with low permeability materials such as clay, reinforced concrete, asphaltic concrete, or a combination thereof. This option would reduce the rate of surface water infiltration, thereby removing the driving force behind contaminant migration into the ground water. The option would also eliminate the potential for wind blow contamination.

7.3.3 GROUND WATER PUMPING AND TREATMENT

Ground water pumping and disposal was evaluated as an interim remedial response in Section 5.3. The necessity for on-site treatment prior to disposal will be evaluated if appropriate. A number of water treatment techniques are available for on-site utilization. Three of these techniques, granular activated carbon (GAC) treatment, air stripping, and activated carbon with ion exchange resins, may be feasible for implementation at the Ortho-Chevron site. Other systems and methods will be evaluated.

A pilot study would be required to design the specific treatment system for the Ortho-Chevron site. Any such pilot study or final design studies are outside the scope of this Work Plan. While a system of this type may be feasible at the Ortho-Chevron site, several disadvantages exist. Limited space is available for construction and operation of a treatment system. Supplemental remediations may be necessary depending upon the type of disposal required.

7.3.4 OTHER LONG TERM POTENTIAL REMEDIAL RESPONSES

The assessment or evaluation of long term remedial responses is beyond the scope of this Work Plan. However, several potential remedial technologies have been considered including:

- o down gradient slurry wall to retard shallow contaminant migration,
- o slurry wall site containment, and
- o upgradient ground water pumping with down gradient recharge.

These technologies are not presently considered appropriate nor cost effective and have not been thoroughly evaluated.

7.4 ALTERNATE CONCENTRATION LIMITS

Based on analytical results of samples collected to date, some ground water contamination has been detected and it is, therefore, possible that cleanup of ground water may be an issue. EPA Region VII has suggested that Alternate Concentration Limit (ACL) provisions, as utilized in the RCRA program, may be applicable to this situation to evaluate the need for clean up and, if necessary, to arrive at acceptable levels for clean up.

The rationale for using ACL's at this site is based on the low potential risk to off-site receptors due to the observed level of on-site chemical concentrations and limited off-site utilization of the ground water.

7.4.1. METHODOLOGY

An ACL demonstration is essentially a risk assessment in which an evaluation of acceptable ground water contamination is made. Criteria are available from EPA which can be used in the preparation of ACL's.

The preparation of an ACL demonstration will be based on very site-specific information, including, but not limited to:

- o physical and chemical waste characteristics,
- o local hydrogeological characteristics,
- o ground water flow direction,
- o proximity of ground water and surface water users,
- o potential health risks,
- o potential damage to wildlife, vegetation and agriculture, and
- o persistence and permanence of potential adverse effects.

Information relating to each of these categories is not required in every ACL demonstration. Dependent upon the site-specific characteristics, each demonstration requires different types and amounts of information.

7.4.1.1 Existing Ground Water Contamination

The first step in establishing ACL's is to characterize the ground water contamination at a downgradient location on the facility. The location should be a vertical surface located hydraulically downgradient on the facility and extending down into the uppermost aquifer. The location of these surfaces will be distinct for the upper and for the bedrock aquifer and will be specified during the ACL process.

The contaminants of concern which have been established by ground water sampling and analysis at the Ortho-Chevron facility include:

- o arsenic,
- o lindane,
- o dieldrin,
- o aldrin,
- o 2,4,5-T,
- o 2,4-D, and
- o xylenes.

These compounds will be included if an ACL demonstration for this facility is undertaken.

7.4.1.2 Location of Receptors and Ground Water Classification

The second step in the evaluation is to establish the location of the nearest downgradient ground water receptors. The primary use of ground water at the identified receptor points will be established. Preliminary background for the classification of the ground water at the site is presented in the June 5, 1986 Site Characterization Report.

7.4.1.3 Allowable Receptor Concentrations

Following the establishment of ground water uses in the area, allowable concentrations at the downgradient receptors will be established. To

protect the public health and drinking water supplies, established drinking water standards (DWS), or maximum contaminant levels (MCL's) will be used where available as the maximum allowable concentration at the receptor points. Published criteria are available for arsenic, lindane, 2,4-D and xylenes. The criteria utilized will be based on the classification of the potential receptor.

For compounds where this information is unavailable, a health effects analysis will be performed using established toxicological data from the literature. Acceptable daily intakes (ADI's), where available, will be used to establish adjusted acceptable daily intakes (AADI's). This adjustment will be made because ADI's are traditionally reported in mg/kg/day but for ACL purposes the level must be measurable in terms of drinking water quality, i.e., concentrations in ug/l.

The compounds dieldrin and aldrin are classed as "non-threshold" compounds due to their potential carcinogenicity. Therefore, a slightly different approach will be used in establishing the maximum allowable concentration at the receptor points to be consistent with regulatory approaches. The additional lifetime cancer risk approach will be utilized in establishing receptor point concentrations. If an ACL demonstration is undertaken, the appropriate additional lifetime cancer risk value will be discussed with EPA prior to proceeding.

7.4.1.4 Back Calculation of Allowable Concentration Levels at the Site

After establishing allowable concentrations at the receptor points, a fate and transport model for the site will be prepared to estimate the concentrations upgradient toward the site. Several three-dimensional models are available and may be applied to back calculate the allowable concentrations at the facility. Judgment will be applied in selecting and in evaluating the results from such models based on the assumptions necessary to make the calculations.

The models are based on many factors including:

- o geology of the site,
- o hydrogeology of the site,
- o climate,
- o surface water hydrology,
- o attenuation properties of the contaminants and geologic materials of concern,
- o degradation properties of the contaminants of concern, and
- o potential exposure pathways.

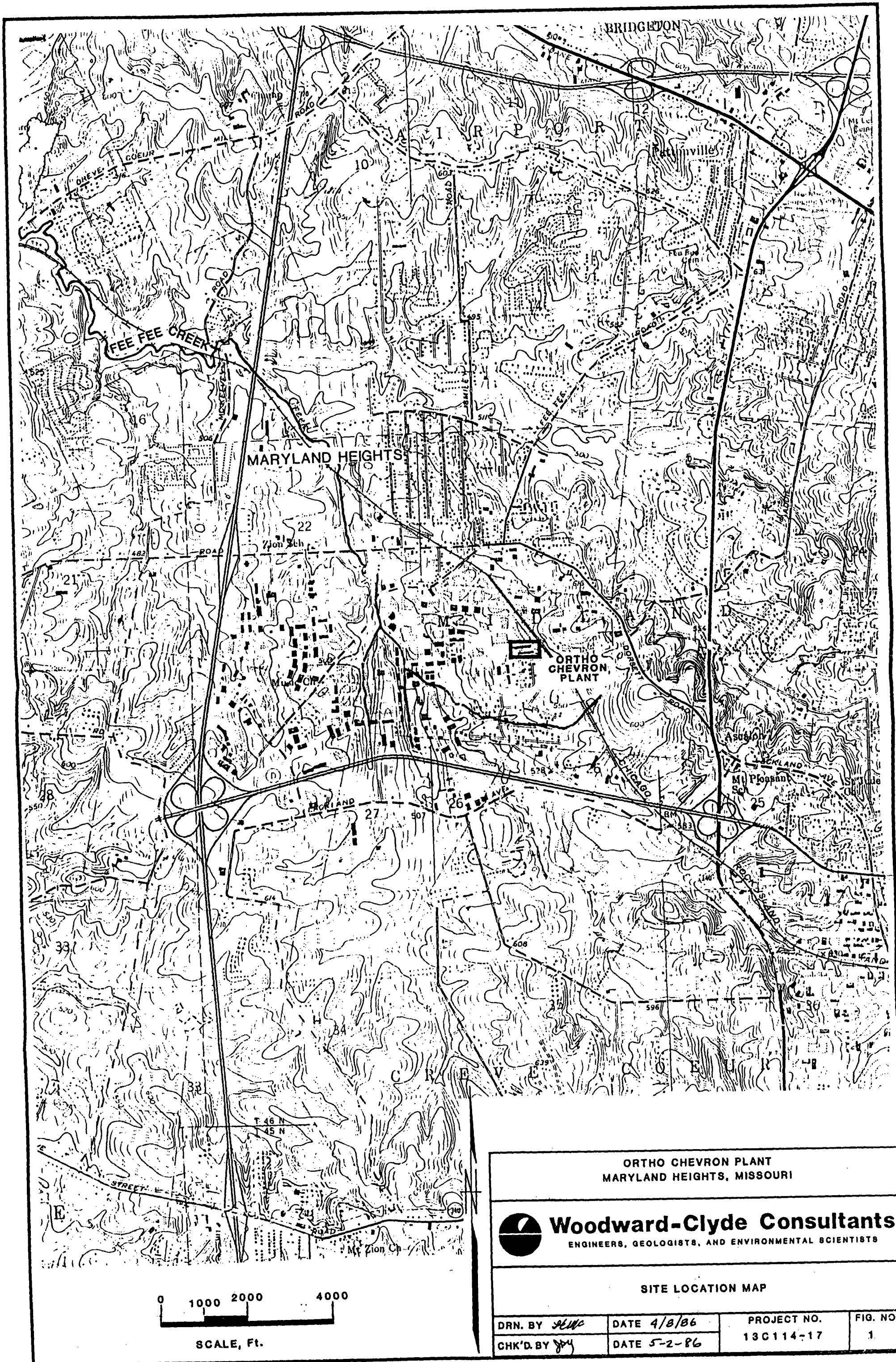
The selection and use of a model will be based on the preceding factors.

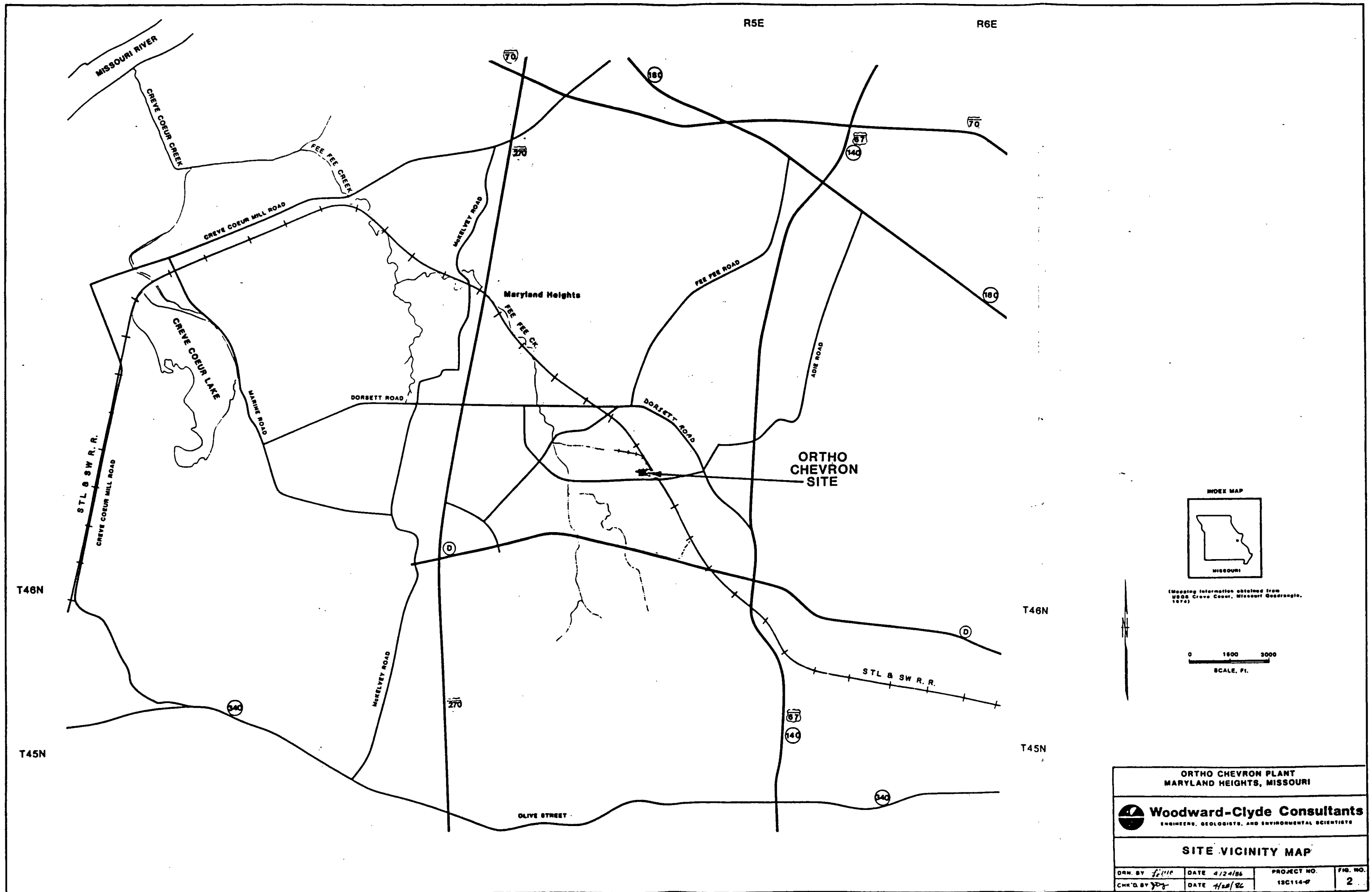
7.5 OTHERS

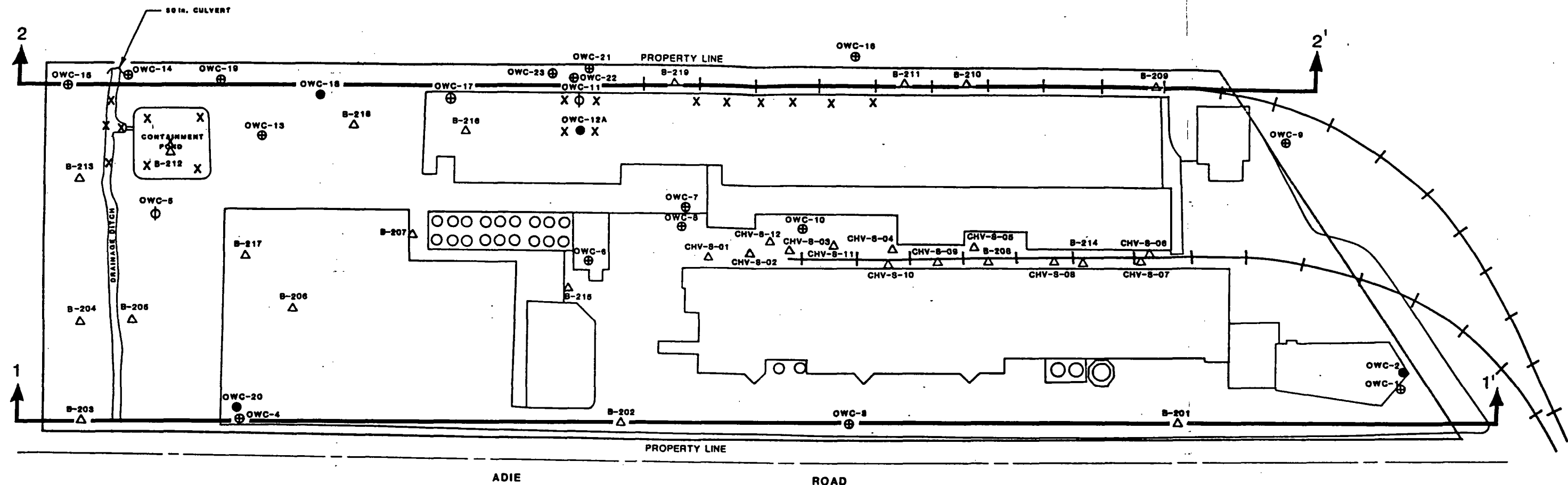
Other potential remedial alternatives not identified here may become evident during the proposed field investigations. These will be reviewed and evaluated as appropriate following their identification.

8.0 SCHEDULE

Figure 10 presents the estimated schedule for work covered by this Work Plan. This schedule also shows decision points where EPA will be briefed on the progress of work to date allowing for Chevron/EPA interaction. The work is estimated to cover a fifteen (15) month period subsequent to the approval of this Work Plan.

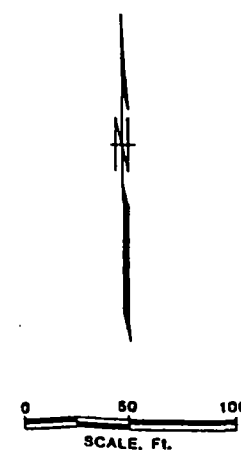





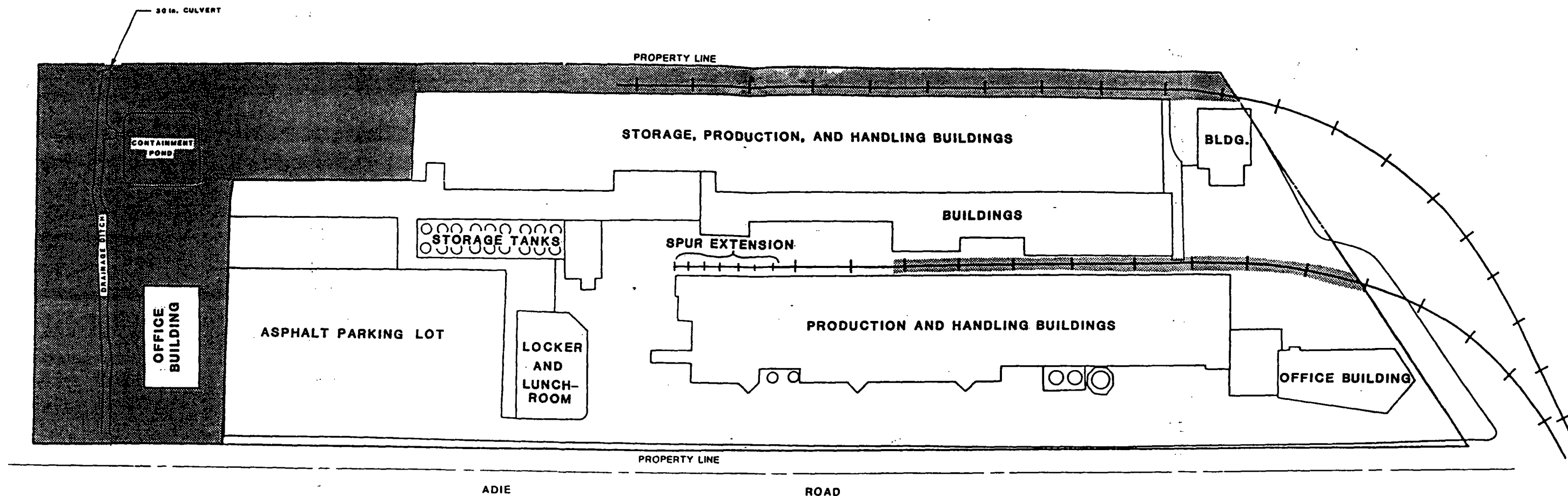


LEGEND

- △ SHALLOW BORINGS
- OWC-1 ⊕ MONITORING WELL LOCATION AND NUMBER
- DEEP MONITORING WELL
- ⊕ INACTIVE MONITORING WELL
- X DIOXIN SURFACE SOIL SAMPLE LOCATION
- ↑↑ CROSS SECTION LOCATION



ORTHO CHEVRON PLANT MARYLAND HEIGHTS, MISSOURI			
 Woodward-Clyde Consultants <small>ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS</small>			
MONITORING WELLS AND BORINGS LOCATION PLAN			
DRN. BY <i>YH</i>	DATE 1/2/86	PROJECT NO. 13C114-17	FIG. NO. 3
CHK'D BY <i>YH</i>	DATE 4/7/86		




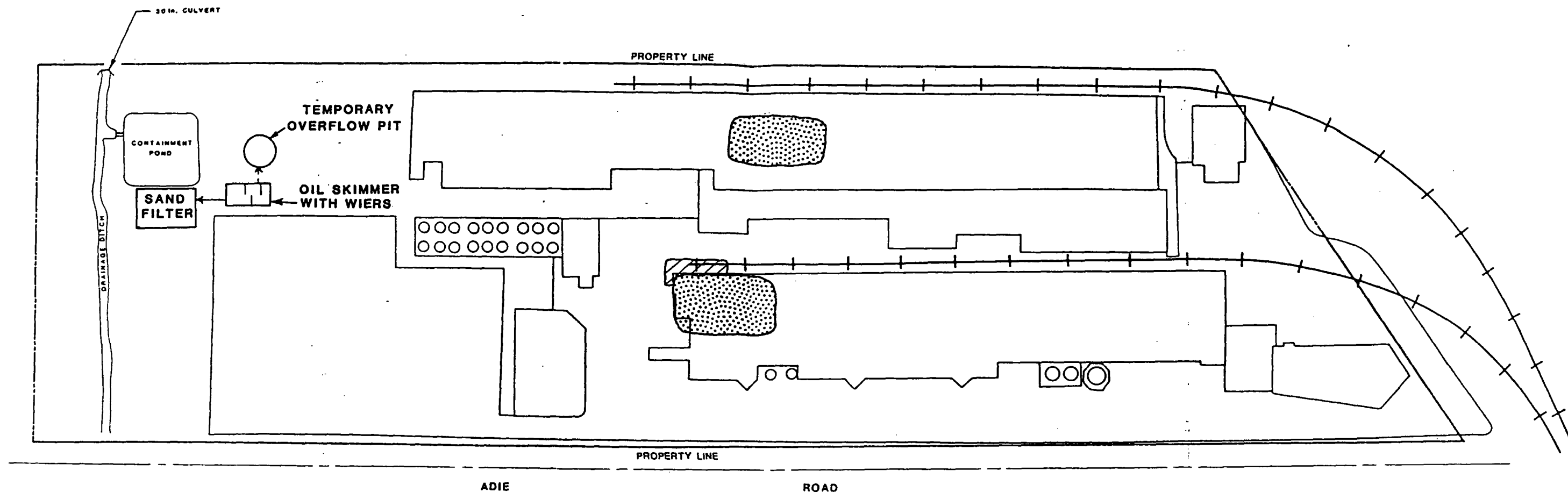
LEGEND



AREAS NOT PAVED OR BUILT OVER

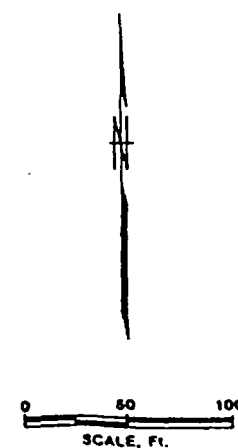



ORTHO CHEVRON PLANT MARYLAND HEIGHTS, MISSOURI			
 Woodward-Clyde Consultants <small>ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS</small>			
SITE FEATURES			
DRW. BY JF	DATE 9-23-86	PROJECT NO.	FIG. NO.
CHK'D BY JSM	DATE 9-23-86	13C114-17	4

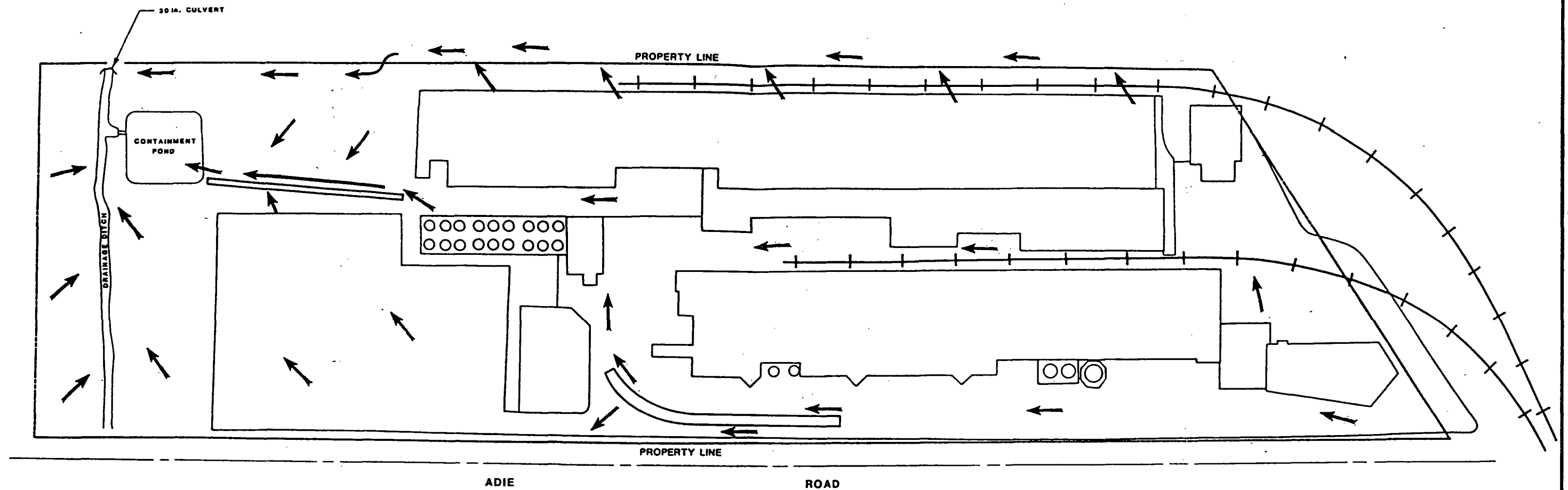


LEGEND

-  PROBABLE LOCATION OF FIRE DEBRIS
-  LOCATION OF FIRE DEBRIS REMOVAL



ORTHO CHEVRON PLANT MARYLAND HEIGHTS, MISSOURI			
 Woodward-Clyde Consultants <small>ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS</small>			
PREVIOUS SAND FILTER FIRE DEBRIS LOCATION			
DRN. BY JF	DATE 9-23-86	PROJECT NO. 13C114-17	FIG. NO. 5
CHK'D BY JDS	DATE 10-27-86		



→ SURFACE RUNOFF FLOWLINE

0 50 100
SCALE, FT.

ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI



Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

SURFACE DRAINAGE PLAN

DRN. BY <i>JF</i>	DATE <i>9-23-86</i>	PROJECT NO. 13C114-17	FIG. NO. 6
CHK'D BY <i>JDM</i>	DATE <i>9-23-86</i>		

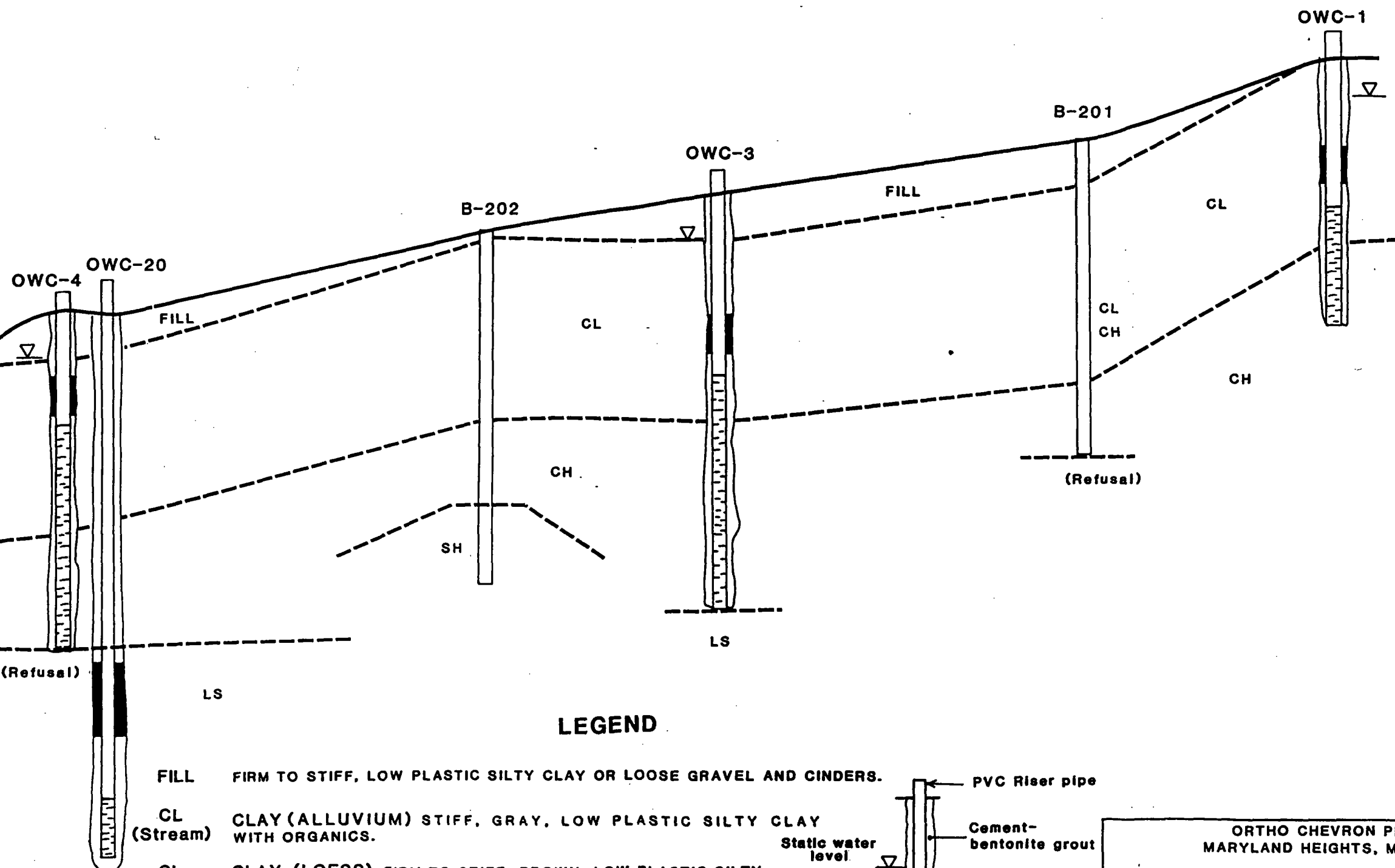
1

ELEVATION, Ft.

550
540
530
520
510
500
490
480

NOTE: Vertical exaggeration of 10:1

0 50 100 200
SCALE, Ft.

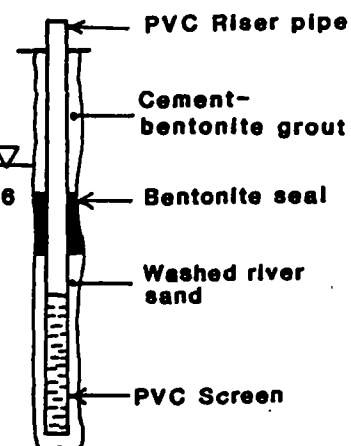


LEGEND

- FILL FIRM TO STIFF, LOW PLASTIC SILTY CLAY OR LOOSE GRAVEL AND CINDERS.
- CL (Stream) CLAY (ALLUVIUM) STIFF, GRAY, LOW PLASTIC SILTY CLAY WITH ORGANICS.
- CL CLAY (LOESS) FIRM TO STIFF, BROWN, LOW PLASTIC, SILTY.
- CH CLAY (RESIDUAL) STIFF TO HARD, BROWN, HIGHLY PLASTIC.
- SH SHALE, HARD, GRAY, UNWEATHERED.
- LS LIMESTONE, LIGHT GRAY, WEATHERED TO UNWEATHERED.

NOTE: These logs have been generalized to illustrate general subsurface conditions. Refer to individual boring logs for details.

Static water level
MAY 1986



ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI



Woodward-Clyde Consultants

ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

GENERALIZED BORING CROSS-SECTION 1-1'

DRN. BY <i>WMC</i>	DATE 4/28/86	PROJECT NO.	FIG. NO.
CHK'D BY <i>WMC</i>	DATE 4/28/86	13C114-17	7

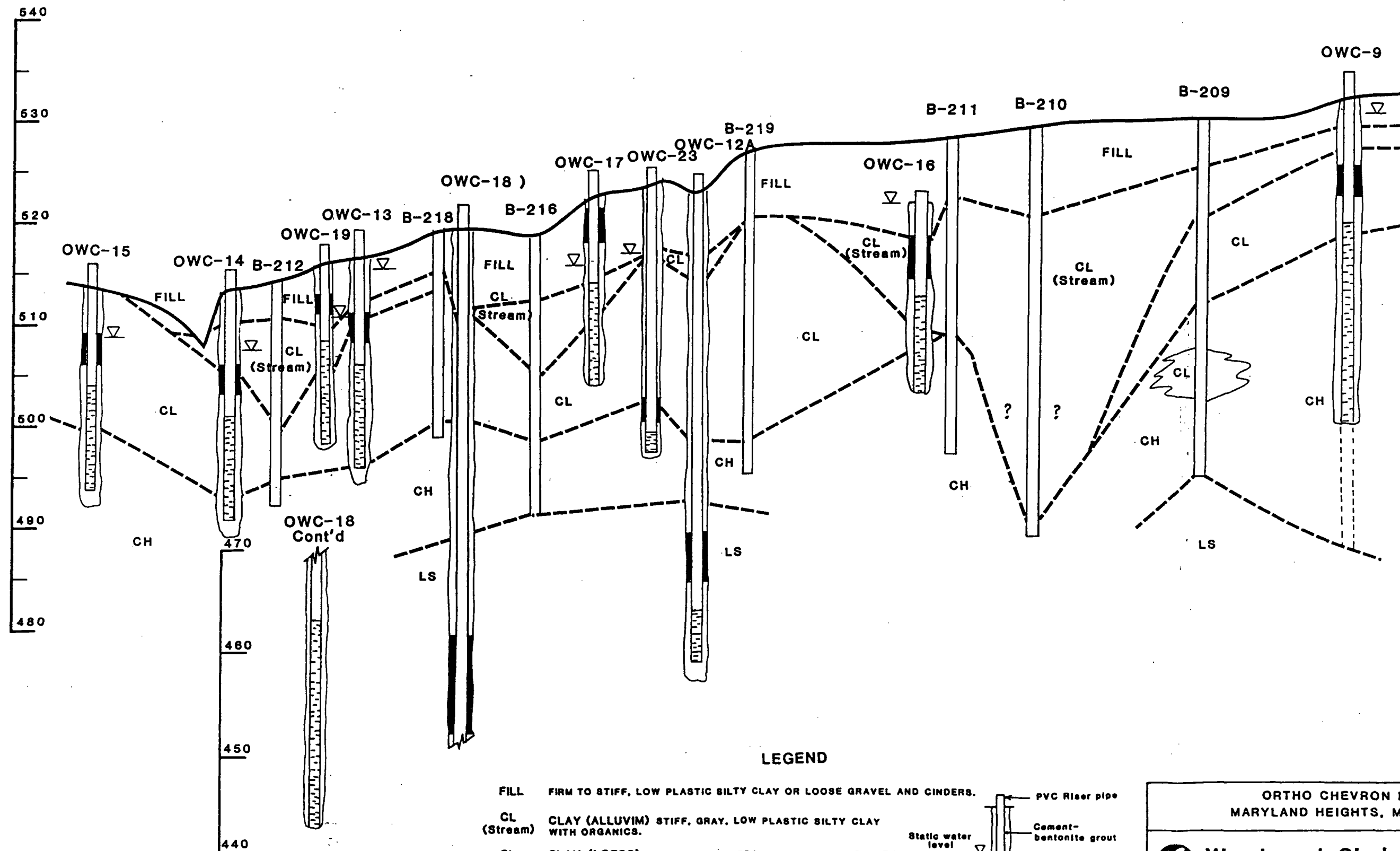
1'

ELEVATION, Ft.

550
540
530
520
510
500
490
480

2
ELEVATION, Ft.

2'
ELEVATION, Ft.

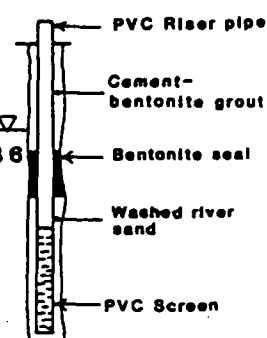


LEGEND

- FILL FIRM TO STIFF, LOW PLASTIC SILTY CLAY OR LOOSE GRAVEL AND CINDERS.
- CL (Stream) CLAY (ALLUVIUM) STIFF, GRAY, LOW PLASTIC SILTY CLAY WITH ORGANICS.
- CL CLAY (LOESS) FIRM TO STIFF, BROWN, LOW PLASTIC, SILTY.
- CH CLAY (RESIDUAL) STIFF TO HARD, BROWN, HIGHLY PLASTIC.
- SH SHALE, HARD, GRAY, UNWEATHERED.
- LS LIMESTONE, LIGHT GRAY, WEATHERED TO UNWEATHERED.

NOTE: These logs have been generalized to illustrate general subsurface conditions. Refer to individual boring logs for details.

Static water level
MAY, 1986



ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI

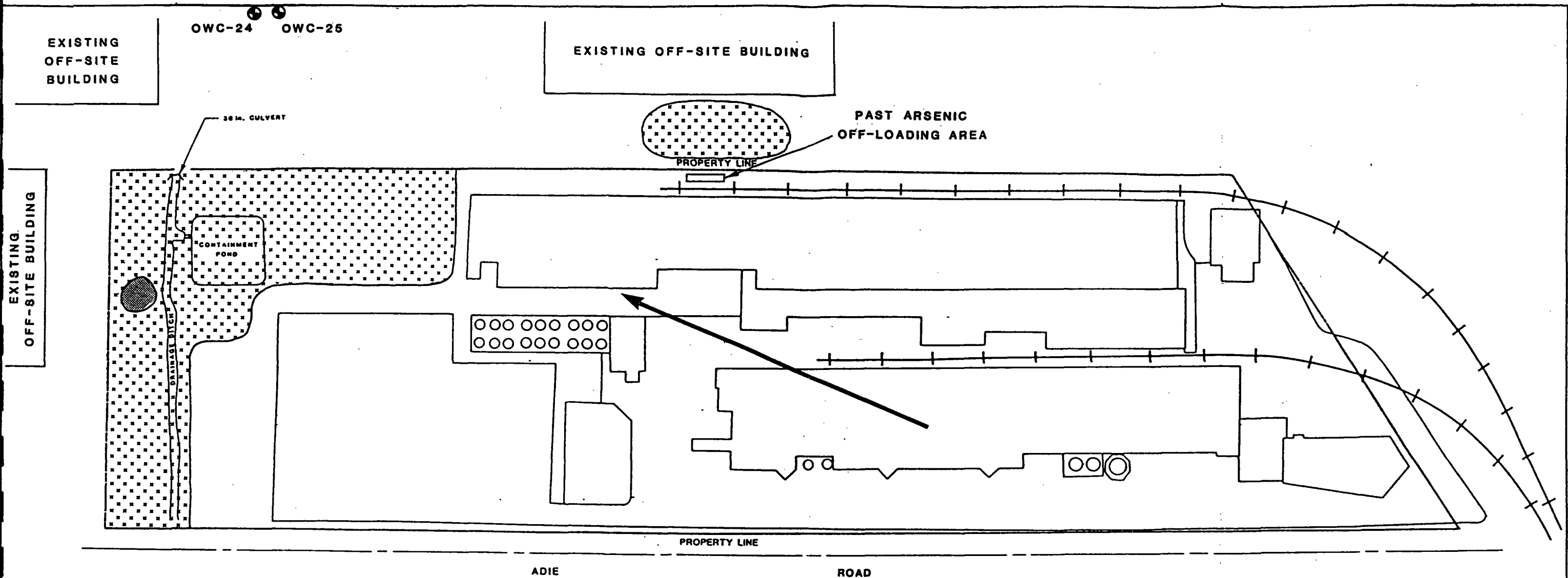


Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

GENERALIZED BORING CROSS-SECTION 2-2'

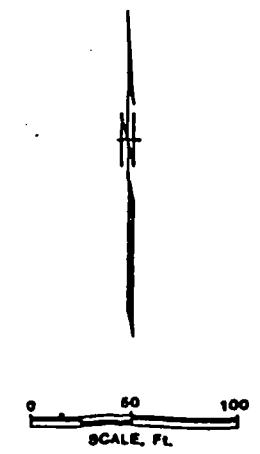
DRN. BY <i>HEMA</i>	DATE 4/28/86	PROJECT NO.	FIG. NO.
CHK'D BY <i>gdy</i>	DATE 7/28/86	13C114-17	8

0 50 100 200
SCALE, Ft.

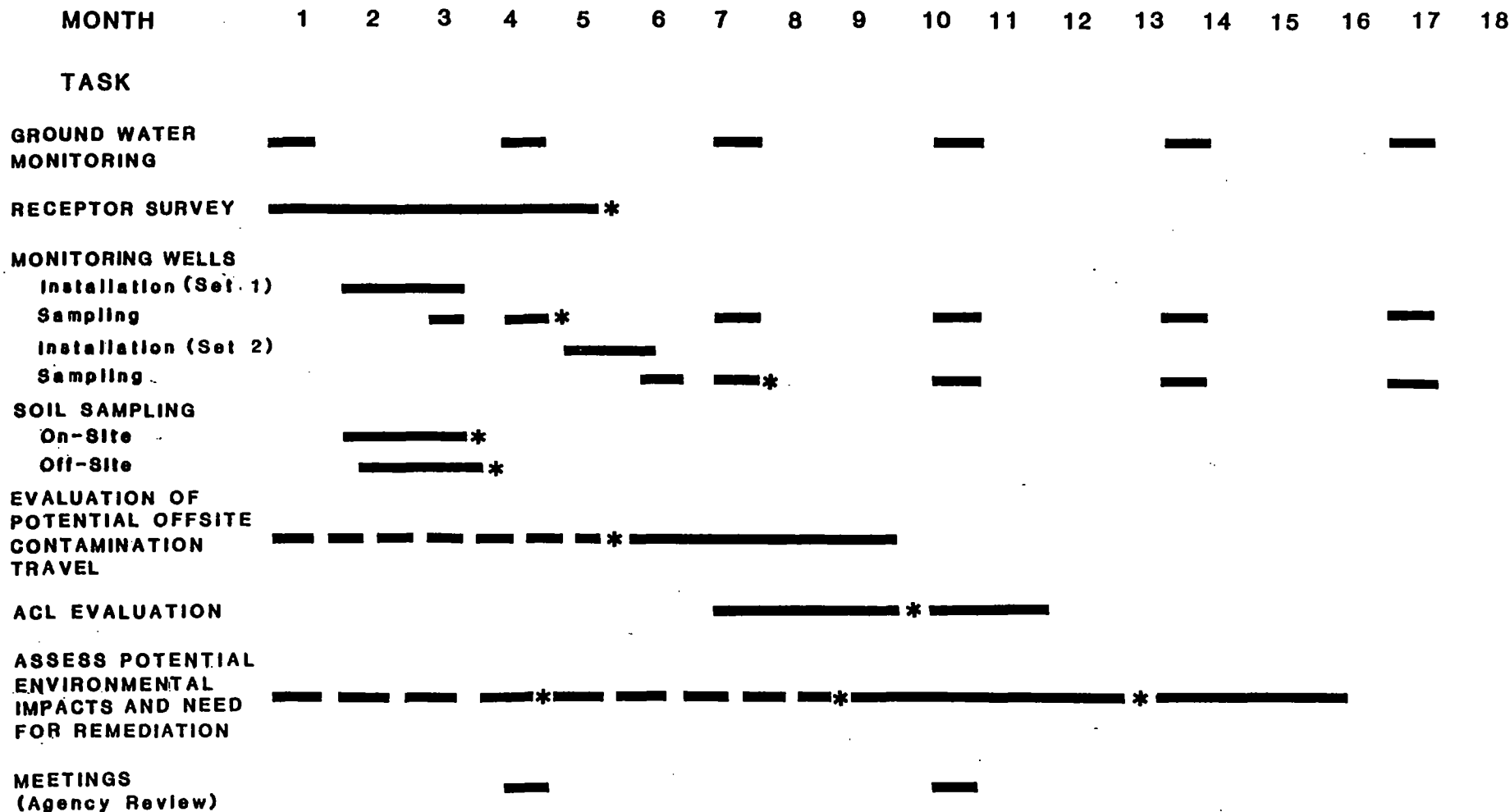


LEGEND

- OWC-24
- PROPOSED MONITORING WELL
- PROPOSED SOIL SAMPLING AREAS
- SUSPECTED MANEB BURIAL AREA
- APPROXIMATE FLOW DIRECTION OF SHALLOW GROUND WATER



ORTHO CHEVRON PLANT MARYLAND HEIGHTS, MISSOURI			
Woodward-Clyde Consultants <small>ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS</small>			
PROPOSED FIELD INVESTIGATIONS			
DRN. BY 97	DATE 6-22-86	PROJECT NO. 13C114-17	FIG. NO. 9
CHK'D BY 98	DATE 6-23-86		



* Decision Points (Chevron / EPA Interaction)

Note: Estimates shown are based on approval of the Work Plan (Section 8).

ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI



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ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

ESTIMATED TIME SCHEDULE FOR
FULFILLMENT OF DATA NEEDS

DRN. BY <i>LENK</i>	DATE <i>12/16/86</i>	PROJECT NO.	FIG. NO.
CHK'D BY <i>SM</i>	DATE <i>12/16/86</i>	13C114-17	10

APPENDIX 1

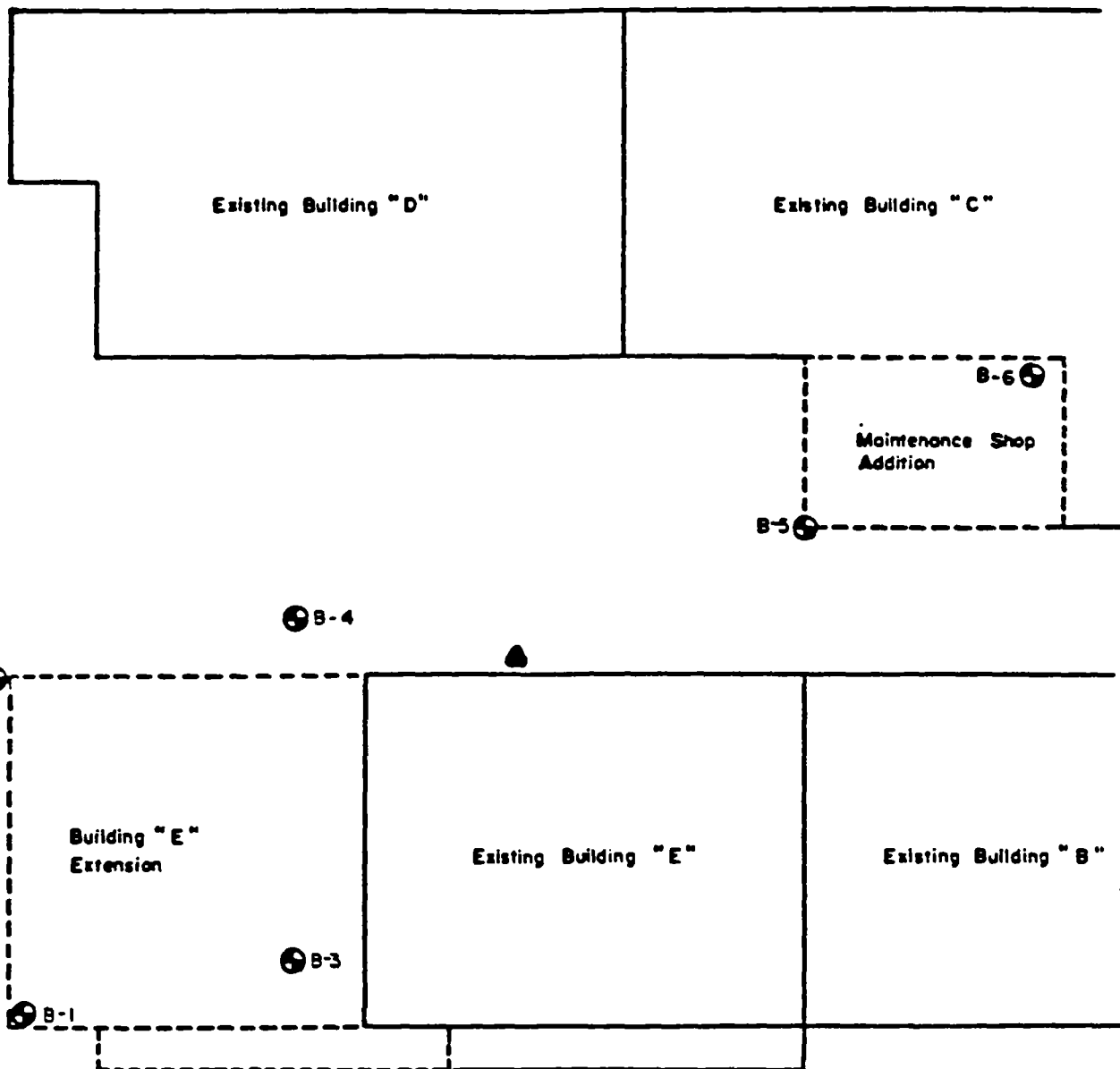
DATA NOT PREVIOUSLY REPORTED

DECEMBER, 1978 SOIL AND FOUNDATION INVESTIGATION
MAINTENANCE SHOP ADDITION AND BUILDING E EXTENSIONS

This investigation was performed for the proposed Maintenance Shop and Building E Extension which was constructed at the Ortho Chevron Chemical Company in Maryland Heights, Missouri. The purposes of this study were to investigate the subsurface conditions at the site, to evaluate the feasibility of a shallow foundation system, and to provide recommendations for the most appropriate deep foundation type if the shallow system was not viable.

Six borings were made on November 6 and 7, 1978 for the two additions. The locations of the four borings in the Building E Extension and the two borings in the Maintenance Shop addition are given on the Site Plan in Figure 1-1. The borings were drilled with a truck-mounted CME-75 rotary drill rig. Borings were advanced with 6-inch hollow stem augers. Soil samples were obtained at selected intervals by either driving a 2-inch diameter split spoon sampler with the standard effort or by hydraulically pushing a 2-inch diameter liner tube sampler. The split spoon sampler was generally used in granular soils and the liner tube sampler in cohesive soils.

The fill in this area appeared to have been placed in an uncontrolled fashion. A drum or piece of drum was drilled through in one of the borings for pier placement, but the exact location and depth are not known.



LEGEND

⊕ - Denotes boring location and number

▲ - Benchmark elevation 78.0' (Plant datum)
Base of pipe stanchion

ORTHO CHEVRON CHEMICAL EXPANSION
MARYLAND HEIGHTS, MISSOURI
CHEVRON CHEMICAL CO

PROJECT NO
13C114-17

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS
CENTRAL REGION

DRN. BY *JBY* 11-17-78
CHKD BY *[Signature]*

SITE PLAN

FIG NO
1-1

APRIL, 1985 SUBSURFACE INVESTIGATION FOR BUILDING EXPANSION

The purpose of the investigation was to evaluate the potential for buried wastes at a proposed building expansion location. The area investigated is located immediately west of the north loading dock, as shown in Figure 1-2, and was previously used for pallet storage.

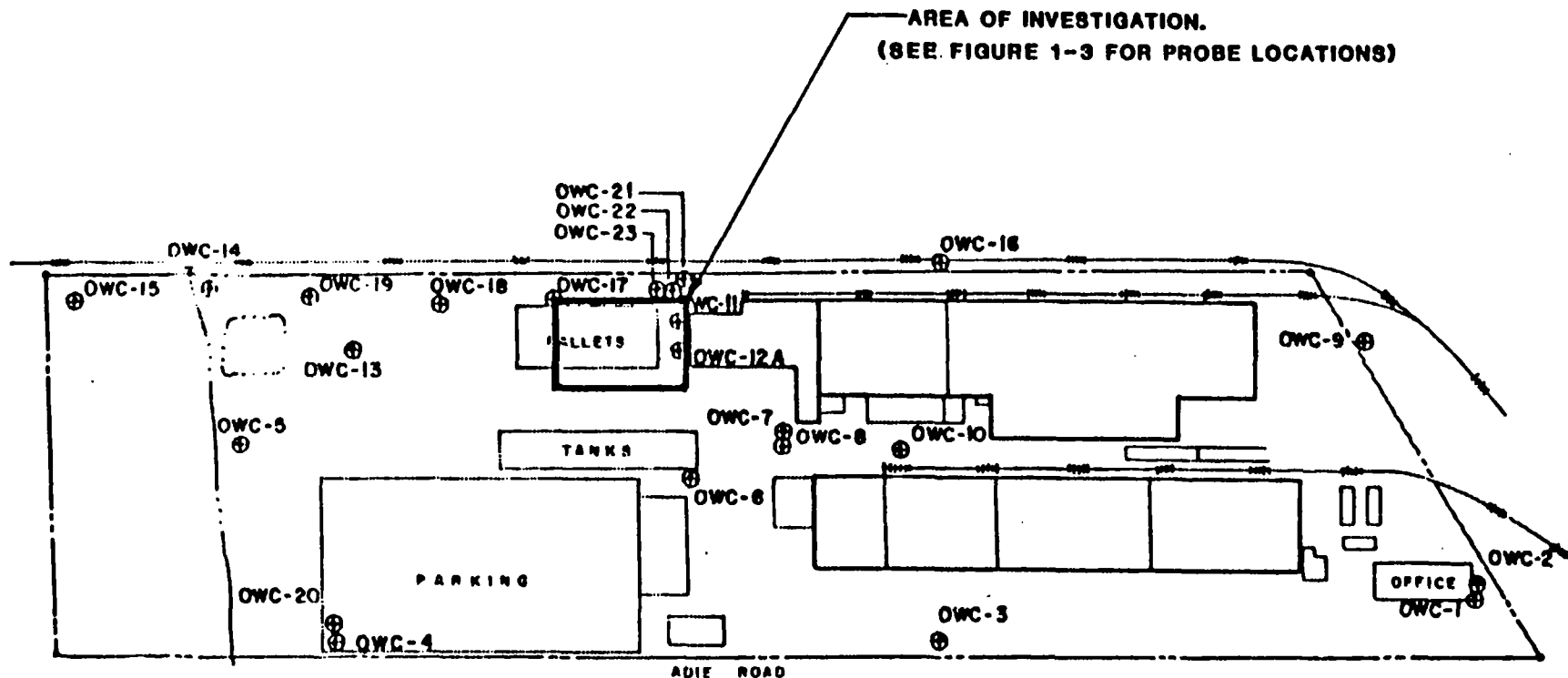
Ninety-six probes on 10-foot centers were drilled to depths of up to 10 feet to evaluate the possibility that trenches of buried wastes might exist in the area proposed for the building expansion. The probe locations are shown in Figure 1-3. Based on principles of geostatistics, the spacing between probes was selected to provide an estimated 75 percent probability of encountering a waste disposal trench if present within the expansion area. The probes were advanced using a trailer-mounted drill rig and 4-inch-diameter continuous-flight augers. The drilling was supervised by WCC's geologist and subsurface conditions logged from the auger cuttings. The probes were then backfilled with the cuttings and sealed with cement grout. Materials which might indicate waste or fire debris disposal were detected in only Probes 2-1, 5-2, 9-5, and 9-6 and are described below. (Probe designation 2-1 is based on the location as shown on Figure 1-3 and is in Row No. 2 and Column No. 1.)

Probe 2-1

Some fragments of glass were observed in the cutting at a depth of approximately 8 feet in this boring.

Probe 5-2

At a depth of approximately 3.5 feet, a thin deposit resembling a white powder was encountered, and at approximately 6 feet a length of steel wire was encountered.



0 50 100
SCALE, ft

GROUND WATER INVESTIGATION
MARYLAND HEIGHTS, MISSOURI
ORTHO-CHEVRON CHEMICAL COMP.

PROJECT NO.
13C114-17

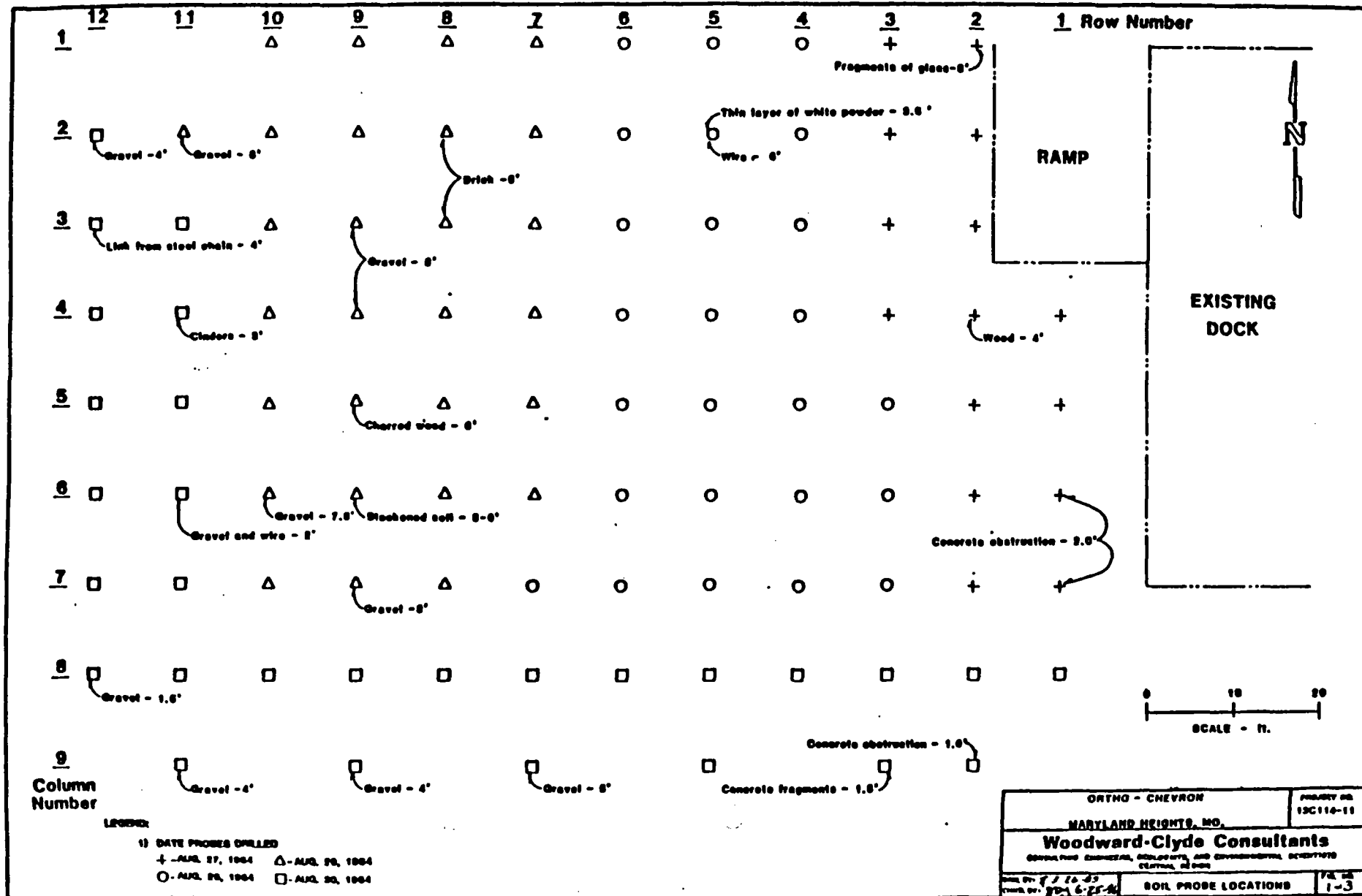
Woodward-Clyde Consultants

CONSULTING ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS
CENTRAL REGION

DRN. BY: 976-23-86
CHKD. BY: 8046-23-86

SITE PLAN-PROBE LOCATIONS

FIG. NO
1-2



Probe 9-5

Charred wood debris was encountered in this boring at a depth of approximately 6 to 7 feet. About 1 foot of fill was encountered beneath the wood but graded into brown silty clay at 10 feet.

Probe 9-6

A deposit described as blackened soil was encountered at a depth interval of approximately 5 to 6 feet.

Although it appears that limited quantities of waste materials may have been incorporated throughout the fill, as may be indicated by the thin zone of white substance encountered in Probe 5-2 at a depth of about 3.5 feet, the probes did not encounter a vertical or lateral expanse of waste, which indicates that it is unlikely that trench disposal of wastes occurred in this area.

OCTOBER, 1986 SOIL SAMPLING WEST OF BUILDING D

On October 17, 1986, 24 soil borings from four quadrants were drilled immediately west of Building D. Soils sampled in this location were placed there as a result of an earlier Building D expansion.

Prior to sampling, all sampling equipment was decontaminated by washing with soap and water, rinsing with potable water, rinsing with methanol, then rinsing with deionized water. The sampling equipment was also decontaminated between sample quadrants in order to reduce the potential for cross contamination.

The crushed rock covering the soil pile (approximately 3/4-inch thick) was removed with a stainless steel trowel. Soil samples were then obtained from the surface to a depth of approximately one foot using a 3-1/2-inch diameter stainless steel bucket auger.

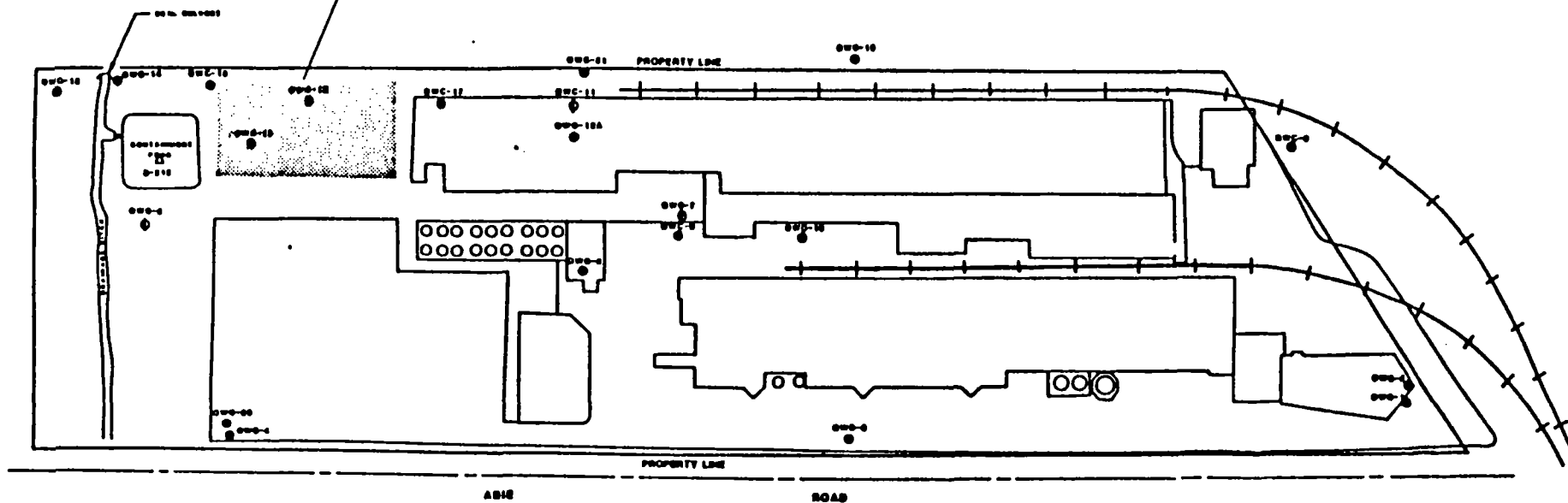
Following sample collection, soil samples from all points within each quadrant were composited and a sample collected and retained for analysis. A fifth composite was then made using the remaining soil from the four original quadrant composites, and a sample of this overall composite was also collected for analysis.

Following sample collection and labeling, all samples were appropriately packaged and shipped to Wilson Laboratories under chain-of-custody protocol for analysis.

Samples OC-NS-1 through OC-NS-4 were analyzed for EP toxicity arsenic only. Sample OC-NS-5 (the overall composite) was analyzed for the parameters detailed in the attached laboratory analytical report.

Complete analytical results and a map (Figure 1-4) detailing sampling locations are attached for reference. Sample quadrants are detailed in Figure 1-5.

APPROXIMATE LOCATION OF SOIL SAMPLES



LEGEND

□ PAVED AREAS

- MW-1 MONITORING WELL LOCATION AND NUMBER
- DEEP MONITORING WELL
- INACTIVE MONITORING WELL

0 50 100
SCALE, FT.

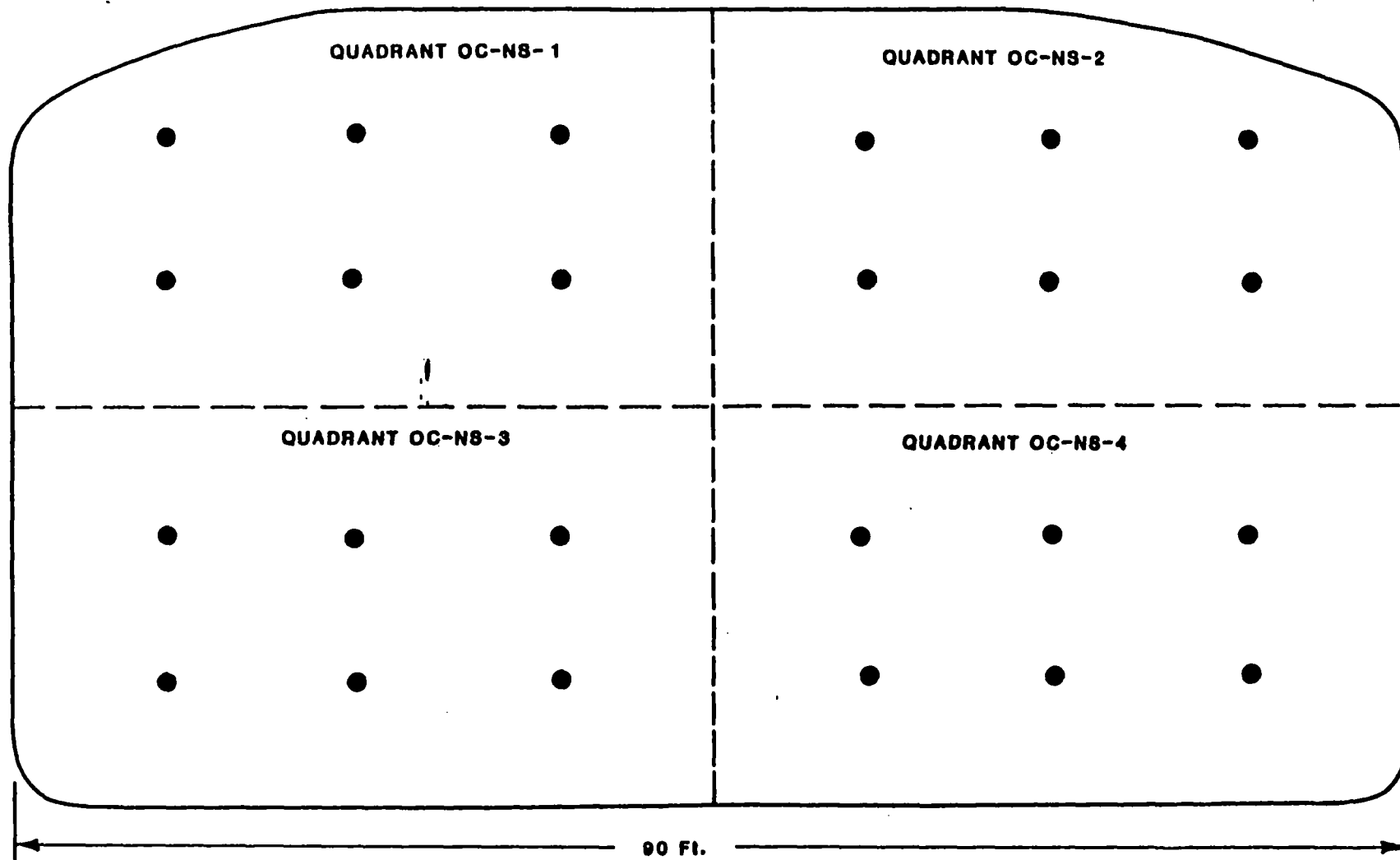
ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI



Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

APPROXIMATE LOCATION OF SOIL SAMPLES

DRN. BY JSC	DATE 9/1/88	PROJECT NO. 19C114-17	FILE NO. 1-4
CHK'D BY JSC	DATE 4/1/89		



ORTHO CHEVRON CHEMICAL PLANT
MARYLAND HEIGHTS, MISSOURI



Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

SOIL SAMPLING LOCATIONS
OCTOBER 1986

DRN. BY <i>DMC</i>	DATE 4/23/87	PROJECT NO. 13C114-17	FIG. NO. 1-5
CHK'D BY <i>DMC</i>	DATE 4/24/87		

525 NORTH EIGHTH STREET - P.O. BOX 1884 - SALINA, KANSAS 67402-1884 - (913)825-7186

LABORATORY REPORT

PAGE 1

CLIENT: WCC (13C114-18) CHEVRON
ATTN: MIKE KIEFER
5055 ANTIOCH ROAD
OVERLAND PARK, KS 66203

DATE RPTD: 12/05/86
DATE RCVD: 11/19/86
PURCHASE AUTH:
FILE NO.: 86-9624
ORDER NO.: 5081

LAB NUMBER: 86120974
SAMPLE DESCRIPTION: OC-NS-1

DATE SAMPLED: 10/07/86
TIME SAMPLED: 1028

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
ARSENIC, EP TOXICITY	0.6	MG/L	884-278

—CONCLUSION—LAB NUMBER: 86120974 OC-NS-1

LAB NUMBER: 86120975
SAMPLE DESCRIPTION: OC-NS-2

DATE SAMPLED: 10/07/86
TIME SAMPLED: 0958

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
ARSENIC, EP TOXICITY	3.6	MG/L	884-278

—CONCLUSION—LAB NUMBER: 86120975 OC-NS-2

LAB NUMBER: 86120976
SAMPLE DESCRIPTION: OC-NS-3

DATE SAMPLED: 10/07/86
TIME SAMPLED: 0939

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
ARSENIC, EP TOXICITY	2.5	MG/L	884-278

—CONCLUSION—LAB NUMBER: 86120976 OC-NS-3

LAB NUMBER: 86120977
SAMPLE DESCRIPTION: OC-NS-4

DATE SAMPLED: 10/07/86
TIME SAMPLED: 1013

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
ARSENIC, EP TOXICITY	0.5	MG/L	884-278

—CONCLUSION—LAB NUMBER: 86120977 OC-NS-4

WILSON LABORATORIES

LABORATORY REPORT

PAGE 2

CLIENT: WCC (13C114-18) CHEVRON

FILE NO.: 86-9624

ORDER NO.: 5081

ND(), WHERE NOTED, INDICATES NONE DETECTED WITH THE DETECTION LIMIT IN PARENTHESES.

ANALYSES WERE PERFORMED ON SAMPLES AS RECEIVED IN ACCORDANCE WITH PROCEDURES PUBLISHED IN THE FEDERAL REGISTER, VOL. 49, NO. 209, OCT. 26, 1984 OR IN EPA PUBLICATION, SW 846, 2ND EDITION, JULY 1982 AND IN THE PROPOSED ADDITION TO SW 846, 1984.

SAMPLES WILL BE RETAINED FOR 30 DAYS UNLESS OTHERWISE NOTIFIED.

WILSON LABORATORIES



LYNN R. NEWCOMER
CHIEF CHEMIST

WILSON LABORATORIES

525 NORTH EIGHTH STREET - P.O. BOX 1884 - SALINA, KANSAS 67402-1884 - (913)825-7186

LABORATORY REPORT

PAGE 1

CLIENT: WCC (13C114-18) CHEVRON
ATTN: MIKE KIEFER
5055 ANTIOCH ROAD
OVERLAND PARK, KS 66203

DATE RPID: 10/29/86
DATE RCVD: 10/08/86
PURCHASE AUTH:
FILE NO.: 86-9624
ORDER NO.: 4678

LAB NUMBER: 86110162
SAMPLE DESCRIPTION: OC-NS-5

DATE SAMPLED: 10/07/86
TIME SAMPLED: 1042

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
EP TOX HERBICIDES			
2,4-D	4.0	UG/L	740-96
2,4,5-TP	ND(1.0)	UG/L	740-96
EP TOX PESTICIDES			
LINDANE	12.7	UG/L	740-96
ENDRIN	ND(0.1)	UG/L	740-96
METHOXYCHLOR	ND(1.0)	UG/L	740-96
TOXAPHENE	ND(5.0)	UG/L	740-96
TOTAL ORGANIC HALOGEN, SOLIDS ANALYSIS	151.	MG/KG	802-8
FLASH POINT (ASTM D-93)	>70.	DEGREES C	815-1
PH, EXTRACTABLE	7.2	STANDARD UNITS	404-95
PHENOLIC COMPOUNDS	ND(0.5)	MG/KG	233-85
REACTIVITY		.	248-99
SOLIDS, TOTAL	83.	%	728-12
CYANIDE @ PH 2	ND(1)	MG/KG	842-11
SULFIDE @ PH 2	ND(1)	MG/KG	248-89
ARSENIC, EP TOXICITY	5.4	MG/L	861-54
BARIUM, EP TOXICITY	ND(1)	MG/L	861-41
CADMIUM, EP TOXICITY	ND(0.01)	MG/L	861-41
CHROMIUM, EP TOXICITY	ND(0.05)	MG/L	861-41
LEAD, EP TOXICITY	ND(0.2)	MG/L	861-41
MERCURY, EP TOXICITY	ND(0.01)	MG/L	861-49
SELENIUM, EP TOXICITY	ND(0.005)	MG/L	861-56
SILVER, EP TOXICITY	ND(0.05)	MG/L	861-50

COMMENTS: NOT REACTIVE IN ACCORDANCE WITH 40 CFR 261.23.

—CONCLUSION—LAB NUMBER: 86110162 OC-NS-5

ND(), WHERE NOTED, INDICATES NONE DETECTED WITH THE DETECTION LIMIT IN PARENTHESES.

ANALYSES WERE PERFORMED ON SAMPLES AS RECEIVED IN ACCORDANCE WITH PROCEDURES PUBLISHED IN THE FEDERAL REGISTER, VOL. 49, NO. 209, OCT. 26, 1984 OR IN EPA PUBLICATION, SW 846, 2ND EDITION, JULY 1982 AND IN THE PROPOSED ADDITION TO SW 846, 1984.

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LABORATORY REPORT

PAGE 2

CLIENT: WCC (13C114-18) CHEVRON

FILE NO.: 86-9624

ORDER NO.: 4678

SAMPLES WILL BE RETAINED FOR 30 DAYS UNLESS OTHERWISE NOTIFIED.

WILSON LABORATORIES

Lynn R. Newcomer
LYNN R. NEWCOMER
CHIEF CHEMIST

FEBRUARY, 1987 ANALYSIS OF FIRE DEBRIS

In June 1986, during excavation of the railroad spur extension retaining wall footings, fire debris was encountered at the northwest corner of Building G. The debris covered an area approximately 8 feet by 8 feet and appeared to extend toward Building G to the south and slightly to the west. The debris did not extend to the north of the railroad spur and was not encountered when the storm drainage ditch was dug.

The debris in the area was approximately 2 to 5 feet deep and was removed and disposed of as the excavation continued toward Building G. Approximately 662 cubic yards of material were removed, of which Chevron believes that 250 cubic yards were actual fire debris. All materials removed were disposed of as hazardous waste.

In February 1987, a sample of the fire debris encountered that had been archived at the Chevron facility was labeled OC-BLDG G Pit and submitted to Wilson Laboratories under chain-of-custody for chemical analysis. The laboratory analytical report and a map (Figure 1-6) detailing the area of excavation are attached for reference.

[illegible]

ORTHO CHEVRON
MARYLAND HEIGHTS, MISSOURI



Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

LOCATION OF FIRE DEBRIS

DRN. BY	DATE	PROJECT NO. 13C114-19	FIG. NO. 1-8
CHK'D BY	DATE		

WILSON LABORATORIES

525 NORTH EIGHTH STREET - P.O. BOX 1884 - SALINA, KANSAS 67402-1884 - (913)825-7186

LABORATORY REPORT

PAGE 1

CLIENT: WCC (13C114-18) CHEVRON
ATTN: JEFF YOUNG
5055 ANTIOCH ROAD
OVERLAND PARK, KS 66203

DATE RPTD: 01/22/87
DATE RCVD: 12/18/86
PURCHASE AUTH:
FILE NO.: 86-9548
ORDER NO.: 5382

LAB NUMBER: 86130832
SAMPLE DESCRIPTION: #OC-BLDG G PIT

DATE SAMPLED: 06/30/86

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
2,4,5-T	ND(100)	MG/KG	870-48
2,4-D	ND(100)	MG/KG	870-48
4,4'-DDD	420.	MG/KG	870-46
4,4'-DDE	637.	MG/KG	870-46
4,4'-DDT	280.	MG/KG	870-46
ALDRIN	ND(100)	MG/KG	870-46
CHLORDANE	1100.	MG/KG	870-46
DIELDRIN	ND(100)	MG/KG	870-46
HEPTACHLOR	ND(100)	MG/KG	870-46
DRINKING WATER PESTICIDES			
LINDANE	9700.	MG/KG	870-46
ENDRIN	ND(100)	MG/KG	870-46
METHOXYCHLOR	ND(100)	MG/KG	870-46
TOXAPHENE	ND(100)	MG/KG	870-46
ARSENIC, TOTAL	3000.	MG/KG	902-387

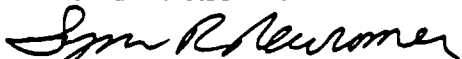
—CONCLUSION—LAB NUMBER: 86130832 #OC-BLDG G PIT

ND(), WHERE NOTED, INDICATES NONE DETECTED WITH THE DETECTION LIMIT IN PARENTHESES.

ANALYSES WERE PERFORMED ON SAMPLES AS RECEIVED IN ACCORDANCE WITH PROCEDURES
PUBLISHED IN THE FEDERAL REGISTER, VOL. 49, NO. 209, OCT. 26, 1984 OR IN EPA
PUBLICATION, SW 846, 2ND EDITION, JULY 1982 AND IN THE PROPOSED ADDITION TO SW 846,
1984.

SAMPLES WILL BE RETAINED FOR 30 DAYS UNLESS OTHERWISE NOTIFIED.

WILSON LABORATORIES



LYNN R. NEWCOMER
CHIEF CHEMIST

FEBRUARY, 1987 ABANDONED SEWER SAMPLING

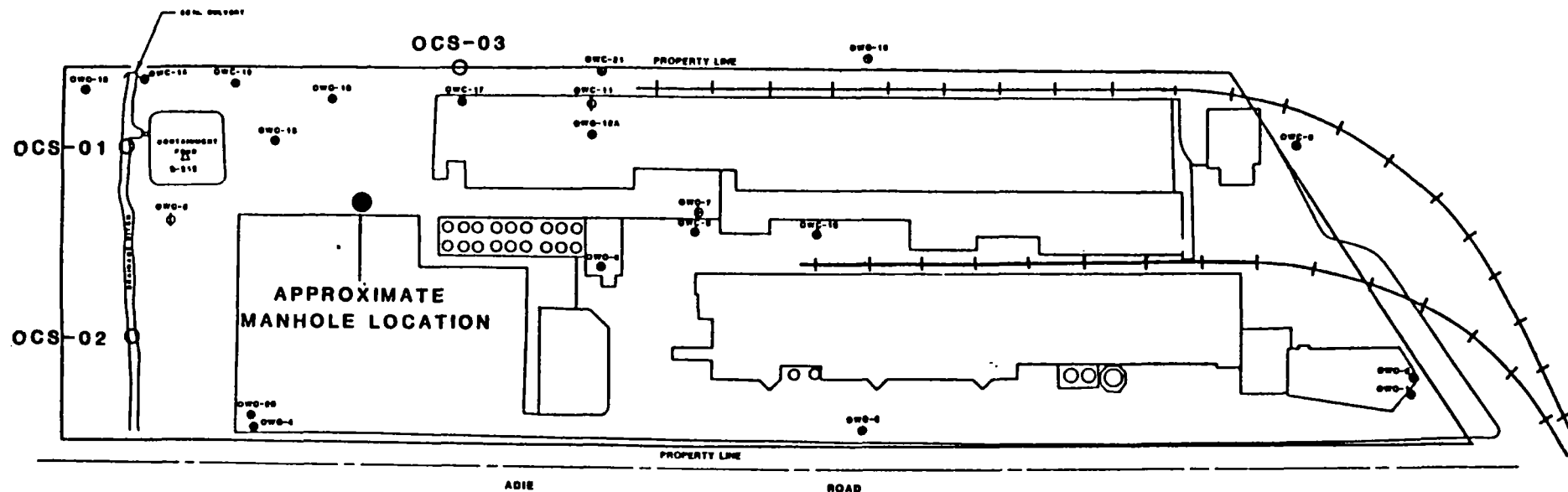
In February 1987, concurrent with the quarterly ground water sampling, a sample (OWC-200) was obtained from an abandoned sewer on-site. Historically the sewer carried storm water runoff but was plugged at the west end and abandoned in 1984.

The sewer was pumped of its contents in May/June 1985 and again in February 1987. These liquids were transferred to the hazardous waste storage tank on-site and ultimately disposed.

The sample obtained in February 1987 was collected utilizing a decontaminated PVC bailer. Access to the sewer was obtained through a manhole located to the southwest of the Building D extension.

Following sample collection and packaging, the sample was shipped with the quarterly ground water samples under chain-of-custody to Wilson Laboratories for analysis.

Laboratory analytical results are attached for reference. The approximate location of the manhole accessed for sampling is illustrated on Figure 1-7.



LEGEND

□ PAVED AREAS

- MONITORING WELL LOCATION AND NUMBER
- DEEP MONITORING WELL
- INACTIVE MONITORING WELL
- March 1987 Sampling Locations

0 50 100
SCALE, FT.

ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI



Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

SITE PLAN

DRN. BY <i>W/C</i>	DATE <i>4/2/86</i>	PROJECT NO. 13C114-17	FIG. NO. 1-7
CHEK'D BY <i>W/C</i>	DATE <i>4/1/86</i>		

LABORATORY REPORT

PAGE 5

CLIENT: WCC (13C114-18) CHEVRON

FILE NO.: 87-9548
ORDER NO.: 6064

LAB NUMBER: 87030358 (CONT.)

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
ARSENIC, FILTERED IN FIELD	17.	MG/L	935-86

—CONCLUSION—LAB NUMBER: 87030358 OWC-19

LAB NUMBER: 87030359
SAMPLE DESCRIPTION: OWC-200DATE SAMPLED: 02/27/87
TIME SAMPLED: 1535

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
2,4,5-T	4.43	UG/L	870-98
2,4-D	605.	UG/L	870-98
4,4'-DDD	8400.	UG/L	870-98
4,4'-DDE	1170.	UG/L	870-98
4,4'-DDT	6380.	UG/L	870-98
ALDRIN	2330.	UG/L	870-98
CHLORDANE	ND(500)	UG/L	870-98
DIELDRIN	937.	UG/L	870-98
HEPTACHLOR	ND(500)	UG/L	870-98
XYLOL	14700.	UG/L	870-97
DRINKING WATER PESTICIDES			
LINDANE	5400.	UG/L	870-98
ENDRIN	ND(500)	UG/L	870-98
METHOXYCHLOR	ND(500)	UG/L	870-98
TOXAPHENE	ND(25000)	UG/L	870-98
ARSENIC, TOTAL	3.8	MG/L	935-86

—CONCLUSION—LAB NUMBER: 87030359 OWC-200

LAB NUMBER: 87030360
SAMPLE DESCRIPTION: OWC-22DATE SAMPLED: 02/27/87
TIME SAMPLED: 1315

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
XYLOL	12.7	UG/L	870-97

—CONCLUSION—LAB NUMBER: 87030360 OWC-22

MARCH, 1987 SEEP/RUNOFF CHANNEL SAMPLING

In March 1987, three surface water samples were obtained on the western portion of the site. These samples included two, labeled OCS-01 and OCS-02, collected from the runoff channel (drainage ditch) on the facility's western border. The third sample, labeled OCS-03, was a seep sample obtained near the northwest corner of Building D.

Following sample collection the samples were appropriately packaged and shipped to Wilson Laboratories under chain-of-custody protocol for chemical analysis.

The laboratory analytical report and a map detailing sample locations (Figure 1-7) are attached for reference.

RECEIVED MAR 23 1987

WILSON LABORATORIES

525 NORTH EIGHTH STREET - P.O. BOX 1884 - SALINA, KANSAS 67402-1884 - (913)825-7186

LABORATORY REPORT

PAGE 1

CLIENT: WCC (13C114-18) CHEVRON
ATTN: JEFF YOUNG
5055 ANTIOCH ROAD
OVERLAND PARK, KS 66203

DATE RPID: 03/20/87
DATE RCVD: 03/05/87
PURCHASE AUTH:
FILE NO.: 87-9548
ORDER NO.: 6116

LAB NUMBER: 87030629
SAMPLE DESCRIPTION: OCS-01

DATE SAMPLED: 03/04/87
TIME SAMPLED: 1100

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
2,4,5-T	ND(1.0)	UG/L	870-98
2,4-D	ND(1.0)	UG/L	870-98
4,4'-DDD	ND(0.1)	UG/L	870-98
4,4'-DDE	ND(0.1)	UG/L	870-98
4,4'-DDT	ND(0.1)	UG/L	870-98
ALDRIN	ND(0.1)	UG/L	870-98
CHLORDANE	ND(0.1)	UG/L	870-98
DIELDRIN	0.19	UG/L	870-98
HEPTACHLOR	ND(0.1)	UG/L	870-98
XYLOL	ND(1.0)	UG/L	870-97
DRINKING WATER PESTICIDES			
LINDANE	21.0	UG/L	870-98
ENDRIN	ND(0.1)	UG/L	870-98
METHOXYCHLOR	ND(0.1)	UG/L	870-98
TOXAPHENE	ND(5.0)	UG/L	870-98
ARSENIC, FILTERED IN FIELD	0.05	MG/L	935-258

—CONCLUSION—LAB NUMBER: 87030629 OCS-01

LAB NUMBER: 87030630
SAMPLE DESCRIPTION: OCS-02

DATE SAMPLED: 03/04/87
TIME SAMPLED: 1130

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
2,4,5-T	ND(1.0)	UG/L	870-98
2,4-D	ND(1.0)	UG/L	870-98
4,4'-DDD	ND(0.1)	UG/L	870-98
4,4'-DDE	ND(0.1)	UG/L	870-98
4,4'-DDT	ND(0.1)	UG/L	870-98
ALDRIN	ND(0.1)	UG/L	870-98
CHLORDANE	ND(0.1)	UG/L	870-98
DIELDRIN	ND(0.1)	UG/L	870-98
HEPTACHLOR	ND(0.1)	UG/L	870-98
XYLOL	ND(1.0)	UG/L	870-97

LABORATORY REPORT

PAGE 2

CLIENT: WCC (13C114-18) CHEVRON

FILE NO.: 87-9548

ORDER NO.: 6116

LAB NUMBER: 87030630 (CONT.)

ANALYSIS	CONCENTRATION	UNITS	BOOK/PAGE
DRINKING WATER PESTICIDES			
LINDANE	ND(0.1)	UG/L	870-98
ENDRIN	ND(0.1)	UG/L	870-98
METHOXYCHLOR	ND(0.1)	UG/L	870-98
TOXAPHENE	ND(5.0)	UG/L	870-98
ARSENIC, FILTERED IN FIELD	ND(0.01)	MG/L	935-151

—CONCLUSION—LAB NUMBER: 87030630 OCS-02

LAB NUMBER: 87030631
SAMPLE DESCRIPTION: OCS-03DATE SAMPLED: 03/04/87
TIME SAMPLED: 1220

ANALYSIS	CONCENTRATION	UNITS	BOOK-PAGE
2,4,5-T	ND(1.0)	UG/L	870-98
2,4-D	ND(1.0)	UG/L	870-98
4,4'-DDD	ND(0.1)	UG/L	870-98
4,4'-DDE	0.15	UG/L	870-98
4,4'-DDT	ND(0.1)	UG/L	870-98
ALDRIN	ND(0.1)	UG/L	870-98
CHLORDANE	ND(0.1)	UG/L	870-98
DIELDRIN	0.38	UG/L	870-98
HEPTACHLOR	ND(0.1)	UG/L	870-98
XYLOL	ND(1.0)	UG/L	870-97
DRINKING WATER PESTICIDES			
LINDANE	125.	UG/L	870-98
ENDRIN	ND(0.1)	UG/L	870-98
METHOXYCHLOR	ND(0.1)	UG/L	870-98
TOXAPHENE	ND(5.0)	UG/L	870-98
ARSENIC, FILTERED IN FIELD	0.70	MG/L	935-258

—CONCLUSION—LAB NUMBER: 87030631 OCS-03

ND(), WHERE NOTED, INDICATES NONE DETECTED WITH THE DETECTION LIMIT IN PARENTHESES.

ANALYSES WERE PERFORMED ON SAMPLES AS RECEIVED IN ACCORDANCE WITH PROCEDURES PUBLISHED IN THE FEDERAL REGISTER, VOL. 49, NO. 209, OCT. 26, 1984 OR IN EPA PUBLICATION, SW 846, 2ND EDITION, JULY 1982 AND IN THE PROPOSED ADDITION TO SW 846, 1984.

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LABORATORY REPORT


PAGE 3

CLIENT: WCC (13C114-18) CHEVRON

FILE NO.: 87-9548
ORDER NO.: 6116

SAMPLES WILL BE RETAINED FOR 30 DAYS UNLESS OTHERWISE NOTIFIED.

WILSON LABORATORIES



LYNN R. NEWCOMER
CHIEF CHEMIST

HEALTH AND SAFETY PLAN
ORTHO-CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI

WOODWARD-CLYDE CONSULTANTS
5055 Antioch Road
Overland Park, Kansas 66203

June 1, 1987

WCC Project 13C114-19

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TABLE 1: ACGIH Threshold Limit Values for Airborne Substances for
Compounds Detected in Soil and Ground Water at the Ortho-Chevron
Site

APPENDIX A: Soil Sample Analytical Data Summary - Phase 1 and Phase 2

APPENDIX B: Operating Procedures No. HS-102

1.0 INTRODUCTION

This Health and Safety Plan describes the procedures and equipment to be used for drilling, monitoring well installation, and sampling work at the Ortho-Chevron agrichemical plant in Maryland Heights, Missouri. The intent of this plan is to provide health and safety procedures for field personnel. Each subcontractor involved with site activity will develop their own health and safety plan that meets or exceeds the approved WCC health and safety plan. This plan shall be the document in force for all subsequent field work at the Ortho-Chevron facility and supercedes any documents which have preceded it.

2.0 SITE DESCRIPTION

The Ortho-Chevron Plant is located in an established industrial area along Adie Road in Maryland Heights, Missouri, as shown in Figure 1.

Ortho-Chevron has been operating at this site for approximately thirty years. Production processes at the plant are now limited to formulating and packaging pesticides. Sources of contaminants at the site may include areas where leaks and spills have occurred over the past thirty years and areas where Maneb fungicide and fire debris have been buried in the past. There are no precise records indicating where leaks and spills may have occurred or where buried wastes may exist.

Figure 2 shows the estimated extent of observed ground water contamination based upon information provided by Chevron and the results of ground water monitoring at the site. The ground water quality data indicate that several sources of contaminants are possibly present within this area.

3.0 WORK DESCRIPTION

Details of proposed scope of work are provided in the Draft Work Plan dated February 9, 1987. Specific details of the work plan may undergo minor revisions following receipt of review comments from the USEPA. However, based on discussions with USEPA and Chevron Chemical, the general scope of field work addressed by this Health and Safety Plan is not expected to change. Any changes which may affect health and safety issues will require an addendum to the Health and Safety Plan.

The field investigation program will consist of the following major elements:

1. On-Site Activities

- a) Ground Water Sampling - field personnel will sample approximately nine on-site monitoring wells on a quarterly basis.
- b) Shallow Soil Sampling - shallow soil samples will be obtained from approximately 70 borings located within the plant property. The borings will be approximately 6 feet deep. Approximately 25 borings will be located within a suspected Maneb burial area. The remaining borings will be located outside the suspected Maneb burial area.

2. Off-Site Activities

- a) Off-Site Well Survey - an off-site well survey will be conducted in the vicinity of the site. This survey will be based on interviews with businesses and residences in the surrounding area and review of available well logs.
- b) Drilling and Well Installation - the Work Plan provides for drilling and installation of two well clusters. Each cluster will consist of two wells (one in the shallow soils, and one in bedrock). The initial well cluster will be located hydraulically downgradient from the plant property. The second well cluster will be established after review of analytical data and off-site

well survey. The need for additional wells at the other locations will be evaluated as appropriate.

- c) Off-Site Ground Water Sampling - the proposed off-site wells described under paragraph 2(b) will be sampled on a quarterly basis.

4.0 HAZARDS IDENTIFICATION

4.1 CHEMICAL HAZARDS

4.1.1 SOIL CONTAMINATION

The previously detected pesticides which may be present in the soil pose a potential for exposure primarily through direct contact with the skin. The detected compounds have very low vapor pressures but high concentrations in the soil may potentially produce moderate concentrations in the air as a result of disturbances during intrusive activities. The relevant Threshold Limit Values (American Conference of Governmental and Industrial Hygienists, ACGIH) for contaminants detected in soil and ground water are presented in Table 1. A summary of chemical analyses for soil samples previously obtained in the railroad spur area (Figure 3) is presented in Attachment A (Table A-1). These analytical data provide evidence that some contamination exists in the soil on-site. The potential for contact with contaminants warrants the existence and implementation of a health and safety plan to protect site personnel.

4.1.2 GROUND WATER CONTAMINATION

Ground water samples have been collected from monitoring wells located in the area of the highest expected contamination. Arsenic has been detected in ground water samples at levels up to 66 milligrams per liter (ppm). Xylenes have been detected in ground water samples at levels up to 30 ppm. The highest observed pesticide levels were up to 6 ppm. These pesticides include lindane, aldrin, dieldrin, 2,4-D, and 2,4,5-T.

TABLE 1

ACGIH THRESHOLD LIMIT VALUES FOR AIRBORNE SUBSTANCES
FOR COMPOUNDS DETECTED IN SOIL AND GROUND WATER
AT THE ORTHO-CHEVRON SITE

<u>Compound</u>	<u>TWA</u> ¹
2,4-D	10 mg/m ³
2,4,5-T	10 mg/m ³
4,4'-DDD	NA
4,4'-DDE	NA
4,4'-DDT	1 mg/m ³
Aldrin	0.25 mg/m ³ *
Dieldrin	0.25 mg/m ³ *
Heptachlor	0.5 mg/m ³ *
Xylenes (Xylol)	100 ppm
Lindane	0.5 mg/m ³ *
Arsenic	0.1 mg/m ³
Chlordane	0.5 mg/m ³ *
Toxaphene	0.5 mg/m ³ *
Endrin	0.1 mg/m ³ *
Methoxychlor	10 mg/m ³

¹ 8-hour, time-weighted average of exposure to airborne substances.

* Additional hazard may result as a result of skin contact with contaminated atmosphere or substance.

The previously detected concentrations of contaminants in ground water may pose a slight to moderate potential for cutaneous contact to personnel performing ground water sampling (or well installation and development). The potential for respiratory exposure is expected to be low due to the relatively non-volatile nature of the compounds.

4.2 PHYSICAL HAZARDS

There is a risk associated with injury resulting from contact with the sampling equipment and drilling rigs used during site investigations. Personnel should be cognizant of the fact that the protective apparel worn may limit visibility, hearing and manual dexterity. Noise from the drilling operations may pose a physical hazard and appropriate preventative measures may be implemented by the Site Safety Officer.

In addition, the protective equipment required may place a physical strain on the wearer. Heat exhaustion or heat stroke are possible, especially during warm weather. All personnel should periodically check the physical condition of their fellow workers for symptoms of heat stress (see Attachment B).

4.3 MEDICAL SYMPTOMS

In general, exposure to the previously detected compounds would be expected to produce symptoms such as irritation of the eyes, nose, throat and skin, headache, dizziness, nausea and muscular tremors. Such acute exposures are not anticipated; however, personnel are advised to be cognizant of these symptoms, and watch for them. If any symptom develops, the Field Coordinator or Site Safety Officer should be notified immediately and appropriate actions should be taken. Important characteristics pertinent to the contaminants identified on the Ortho-Chevron Plant Site are shown below.

2,4-D

2,4-D is a colorless^{*}, odorless solid. When heated to decomposition it will emit toxic fumes of CL-. Exposure to 2,4-D may result in weakness and stupor; hyporeflexia; muscle twitches; convulsions; and dermatitis.

Threshold Limit Value (TLV): 10 mg/m³
Immediately Dangerous to Life or Health (IDLH): 500 mg/m³

2,4,5-T

2,4,5-T is a colorless to tan, odorless, crystalline solid. It is not combustible. Signs of intoxication (usually via inhalation and ingestion) include weakness, lethargy, anorexia, diarrhea, ventricular fibrillation and/or cardiac arrest and death. 2,4,5-T is an experimental teratogen due in part to 2,3,7,8-TCDD, which is present as a contaminant.

Threshold Limit Value (TLV): 10 mg/m³
Immediately Dangerous to Life or Health (IDLH): 5000 mg/m³

Aldrin

Aldrin is a tan to dark brown solid with a mild chemical odor. NIOSH has recommended that aldrin be treated as a potential human carcinogen. Ingestion, inhalation or absorption of this material into the body can cause irritability, convulsions and depression in from 1 to 5 hours. Continued exposure causes liver damage.

*Threshold Limit Value (TLV): 0.25 mg/m³
Immediately Dangerous to Life or Health (IDLH): NA

Dieldrin

Dieldrin is a colorless to light tan solid with a mild, chemical odor. NIOSH has recommended that dieldrin be treated as a potential human carcinogen. Early symptoms of dieldrin intoxication include headache, nausea, and general malaise. With more severe poisoning, convulsions may ensue; coma may or may not follow. Hyperexcitability and hyperirritability are common findings.

Threshold Limit Value (TLV): 0.25 mg/m³
Immediately Dangerous to Life or Health (IDLH): NA

Heptachlor

Heptachlor is a light tan, waxy solid with an odor like camphor. It may be dissolved in flammable liquid. Heptachlor is an experimental carcinogen with high toxicity when exposure occurs orally and through skin contact. Acute exposure may cause liver damage supplemented by tremors, convulsions, kidney damage, respiratory collapse, and death.

Threshold Limit Value (TLV): 0.5 mg/m³
Immediately Dangerous to Life or Health (IDLH): 100 mg/m³

Xylene

Xylene is a colorless liquid with an aromatic odor. Xylene may pose a moderate health threat when exposures occur via inhalation and ingestion. Exposure to xylene may cause dizziness, drowsiness and a staggering gait when observed through inhalation. Upon ingestion, xylene may cause irritation to the eyes, nose, and throat.

Threshold Limit Value (TLV): 100 ppm
Immediately Dangerous to Life or Health (IDLH): 1000 ppm

Upper Explosive Limit (UEL): 6/7/7% *
Lower Explosive Limit (LEL): 1/1.1/1.1% *

* Values shown for o-, m-, and p-isomers, respectively.

Lindane

Lindane is a colorless solid with a musty odor. It is not combustible itself, but may be dissolved in combustible solvent. Exposure may cause irritation to the eyes, nose, and throat accompanied by headache and nausea. Clonic convulsions may be observed as well as respiratory problems and muscle spasms.

Threshold Limit Value (TLV): 0.5 mg/m³
Immediately Dangerous to Life or Health (IDLH): 1000 mg/m³

Arsenic

The appearance and odor of arsenic varies with individual compounds. The chemical and physical properties also vary depending upon the specific compound. Arsenic intoxication may result in ulceration of the nasal septum, dermatitis, and GI disturbances. Respiratory irritation and hyperpigmentation of the skin may occur. NIOSH has recommended that arsenic be treated as a potential human carcinogen.

Threshold Limit Value (TLV): 0.1 mg/m³
Immediately Dangerous to Life or Health (IDLH): N/A

Chlordane

Chlordane is a thick, amber liquid with a chlorine-like odor. It is an experimental carcinogen that is considered quite toxic. Chlordane is a CNS stimulant that may produce blurred vision, confusion, and delirium upon exposure. Nausea, vomiting, diarrhea, and tremors may occur as well.

Threshold Limit Value (TLV): 0.5 mg/m³
Immediately Dangerous to Life or Health (IDLH): 500 mg/m³

Toxaphene

Toxaphene is a yellow, waxy solid with a pleasant piney odor. It is an experimental carcinogen that poses a high health threat if ingested and a moderate threat upon skin contact. Exposure may cause CNS stimulation with tremors, convulsions, and death. Liver injury may also occur.

Threshold Limit Value (TLV): 0.5 mg/m³
Immediately Dangerous to Life or Health (IDLH): NA

Endrin

Endrin is a colorless to tan solid with a mild chemical odor. It is not combustible, but may be dissolved in flammable solvent. Exposure to endrin may result in convulsions, stupor, headache, dizziness, and nausea. Insomnia, lethargy, weakness, and anorexia may also occur.

Threshold Limit Value (TLV): 0.1 mg/m³
Immediately Dangerous to Life or Health (IDLH): 200 mg/m³

Methoxychlor

Methoxychlor is a colorless to tan solid with a slight fruity odor. Symptoms of exposure are not known in humans; however, trembling, convulsions, kidney damage, and liver damage have been observed in animals.

Threshold Limit Value (TLV): 15 mg/m³
Immediately Dangerous to Life or Health (IDLH): 7500 mg/m³

In addition, to the above medical symptoms, heat stress may also be encountered during field activities at the Ortho-Chevron site. Symptoms of heat stress include nausea, headache, weakness or dizziness accompanied by

extreme perspiration. If any worker is observed to suddenly stop perspiring (a symptom of heat stroke) immediate medical attention is required.

4.4 SITE ACCESS

During the performance of field activities, only personnel who are involved in the activities should remain in the immediate area. Intrusive activities by their nature pose the greatest potential for contact with contaminated media (soil or water). During such activities, a 20-foot-radius restricted zone may be established by means of red or yellow surface tape, to control access to the area of intrusive work. The Site Safety Officer is responsible for establishing restricted zones and for controlling access to specific areas as deemed appropriate.

5.0 PERSONNEL PROTECTION

5.1 PROTECTION LEVELS

The following equipment will be worn by personnel engaged in on-site field work outside of area 1 as detailed in Figure 4 and in off-site field work and monitoring well installation, development and sampling. The personnel protective equipment detailed below is equivalent to USEPA modified Level D protection.

The required equipment includes:

- o Tyvek coverall (drilling and soil sampling)
- o PVC or Saran-coated Tyvek coverall (well development and sampling)
- o Latex or vinyl surgical gloves
- o Nitrile or neoprene work gloves (taped at wrists)
- o Neoprene or PVC work boot (protective booties may be substituted for activities other than well installation, development, and sampling)
- o Hard hat
- o Goggles (or safety glasses)

The following equipment, equivalent to USEPA Level C protection, is required for on-site field work, including drilling and soil sampling within area 1 as detailed in Figure 4.

The required equipment includes:

- o PVC or Saran-coated Tyvek coverall
- o Tyvek cover-all (inner suit, optional)
- o Vinyl or latex surgical gloves
- o Butyl rubber inner gloves
- o Neoprene or PVC work boot (steel-toe for drilling)
- o Latex protective shoe covering (optional)
- o Hard hat
- o Full face, air purifying respirator with organic vapor cartridge and dust filter (MSA Ultratwin respirator with GMA-H cartridge, or equivalent)

Personnel conducting the off-site well survey will not be required to wear protective equipment. Ten-minute ELSA packs will be provided as an escape device for operations conducted in Level C protective equipment.

5.2 MODIFYING LEVELS OF PROTECTION

The required level of protection may be modified by the Site Safety Officer (SSO) in response to changes in the quality of the work environment. Upgrades from initial modified Level D to Level C protection (and subsequent return to Level D) may be authorized by SSO. Other modifications require the consultation with either the Business Unit Health and Safety Officer (HSO) or the Corporate Health and Safety Officer.

Upgrade from Level C to Level B (supplied air) is not anticipated based on knowledge of the contamination at the site. If conditions should warrant such a modification (the criteria for which are discussed in paragraph 5.3), site work will stop pending assessment by the WCC HSO and preparation of an addendum to this plan.

Downgrade from Level C to modified Level D protection within area 1 (Figure 4) will not be permitted for intrusive activities without consulting the Business Unit Health and Safety Officer.

5.3 AIR QUALITY CRITERIA FOR ESTABLISHING LEVELS OF PROTECTION AGAINST EXPOSURE TO HAZARDOUS ORGANIC VAPORS

During the course of the investigation, ambient air quality will be monitored in the vicinity of intrusive activities and well sampling operations. The equipment used will be a HNu or Century System OVA-128 operated in the survey mode.

For each field activity, background air quality will be determined at a position upwind of the work area.

Activities approved for modified Level D protection can proceed at that level contingent upon the presence of satisfactory air quality in the breathing zone. One criterion for upgrade to Level C is the presence of concentrations of 5 ppm (or more) above background, as measured in the breathing zone.

A summary of action levels follows:

Modified Level D	0-5 ppm above background
Level C	5-10 ppm above background and/or visual observation of nuisance dust while drilling
Exit Site	Greater than 10 ppm above background

5.4 ADDITIONAL HEALTH AND SAFETY DIRECTIVES

No eating, drinking, smoking, or any other activity involving hand-to-mouth contact (e.g., tobacco chewing) will be allowed in the field. Personnel should thoroughly wash their hands and faces before eating, drinking, or smoking.

Because of the nature of operation of respirators, personnel engaged in activities requiring Level C protection will not be allowed to have facial hair that interferes with respirators. The Site Safety Officer will determine if facial hair presents such an interference. No one will be allowed to work in a respirator if they have not been fit-tested within one year of the date field activities begin, or if they have failed the fit test.

Contact lenses may not be worn on site. Personnel expected to use respirators should provide a pair of glasses that can be adapted to the mask worn (the appropriate mounting hardware will be provided). All other personnel should provide their own prescription glasses.

6.0 DECONTAMINATION PROCEDURES

6.1 DRILL RIG AND SAMPLING EQUIPMENT DECONTAMINATION

Procedures for the decontamination of drilling and sampling equipment are presented in the sampling plan.

6.2 PERSONNEL DECONTAMINATION

Decontamination of personnel and small tools will be performed at a designated location at each site. The specific configuration of the decontamination area will be established in the field by the Field Coordinator or Site Safety Officer. Personnel decontamination will consist primarily of soap-and-water washings and water rinse of exterior protective gear to remove potential contaminants, followed by doffing of the gear. Coveralls should be removed by turning the clothing inside out. The general sequence of doffing procedures is outlined below. The extent of washing required, or modifications to the sequence, may be specified by the Project Manager or Site Safety Officer.

Steps in decontamination will be:

1. Wash work gloves and boots;
2. Rinse work gloves and boots;
3. Wash and rinse outer protective coverall (and respirator, if worn);
4. Untape wrists and ankles;
5. Remove goggles (respirator mask, if worn);
6. Remove outer suit (also gloves, hard hat);
7. Wash and rinse inner gloves;
8. Remove boots;
9. Remove inner gloves;
10. Shower as soon as possible upon completion of work.

6.3 DISPOSAL OF DECONTAMINATION AND DRILLING BY-PRODUCTS

Solids generated from personnel decontamination will be placed into plastic trash bags and left with Chevron who is responsible for appropriate and proper disposal.

Drill cuttings and cuttings from soil sampling locations will be backfilled in the boring upon completion at each location. It is not anticipated that any significant amount of drilling fluids will be produced by drilling activities that are likely to be conducted at the site.

Decontamination liquids will be allowed to discharge to the ground at the designated decontamination area(s).

7.0 MEDICAL MONITORING PROGRAM

All WCC and subcontractor personnel working on the project will be required to meet the provisions of the WCC medical monitoring program. Persons who have not had the equivalent of the WCC physical will be required to complete an examination prior to working on the site. Subcontractors or consultants who maintain their own medical programs may submit the details of the program to the WCC Eastern Operating Group Health and Safety Officer (HSO) for review; additional physical examinations may or may not be required. All personnel who have not had a WCC annual physical within the last year will be required to take a WCC physical prior to site work. At the discretion of the HSO, exit physicals may be performed on personnel who have worked at the site. The required components of this exit physical will be specified by the WCC HSO (following discussion with WCC's medical consultants) prior to completion of the site work.

8.0 SAFETY TRAINING

All WCC and subcontractors' personnel will be required to have experience and formal training in hazardous waste health and safety procedures and the use of personal protective equipment equivalent to Level C. All WCC and subcontractor personnel will be familiarized with the specific tasks to be performed and the health and safety issues prior to working on the site. This information may be delivered during a structured training program or in an informal briefing, depending upon the scope of work. The information will include: 1) a briefing on the work to be performed and the work schedule, 2) a discussion of the potential chemical and physical hazards associated with the work to be performed, 3) purpose, maintenance, storage and limitations of personnel protective equipment (including practical exercises, if appropriate), 4) decontamination procedures (including practice, if appropriate), 5) emergency response procedures, and 6) the use of monitoring equipment. The Site Safety Officer, or his designee, will conduct the training session.

Prior to field work, all personnel will be fit-tested on the respirator to be used. No one will be allowed to work in the respirator for which they have not been fit-tested, or if they have failed a qualitative fit test.

All personnel will be required to read the Health and Safety Plan and sign the Compliance Agreement located in Section 12.0 of this plan.

9.0 EMERGENCY RESPONSE PROCEDURES

In the event of fire, explosion, chemical exposure, injury, or other accidents, the appropriate emergency response agency will be contacted. Emergency response agencies and their telephone extension numbers are listed below and will be posted on site.

<u>Agency</u>	<u>Telephone</u>
On-site Contacts:	
Bill Springer - Safety Supervisor	1-314-432-8234
Doug Jefferies - Technical Supervisor	1-314-432-8234
Maryland Heights Fire Department	1-314-878-7000
Ambulance	1-314-428-1122
Maryland Heights Police Department	1-314-298-8700
Poison Control	1-314-772-5200
Hospital (DePaul)	1-314-344-6000

The nearest hospital is located approximately five (5) miles from the site. The route to be followed to the hospital is:

- o Aide Road North to St. Charles Rock Road
- o St. Charles Rock Road West 3 1/2 miles
- o DePaul Health Center is on the south side of St. Charles Rock Road at I-270

10.0 PROJECT SAFETY PERSONNEL

Because site work is performed periodically, a full-time Site Safety Officer will not be identified. A Site Safety Officer will be designated for each field task performed. This person will be familiar with the Ortho-Chevron site, the specific field tasks to be performed, and health and safety protocol.

11.0 SAFETY PLAN APPROVAL

Wayne D. Smith

Wayne D. Smith,
WCC Project Manager

6/2/87
Date

Dennis Y. Takade

Dennis Y. Takade, Ph.D.
WCC Health and Safety Officer

6/2/87
Date

Dennis Y. Takade for

Martin E. Kemplin
WCC Eastern Operating Group Health &
Safety Officer

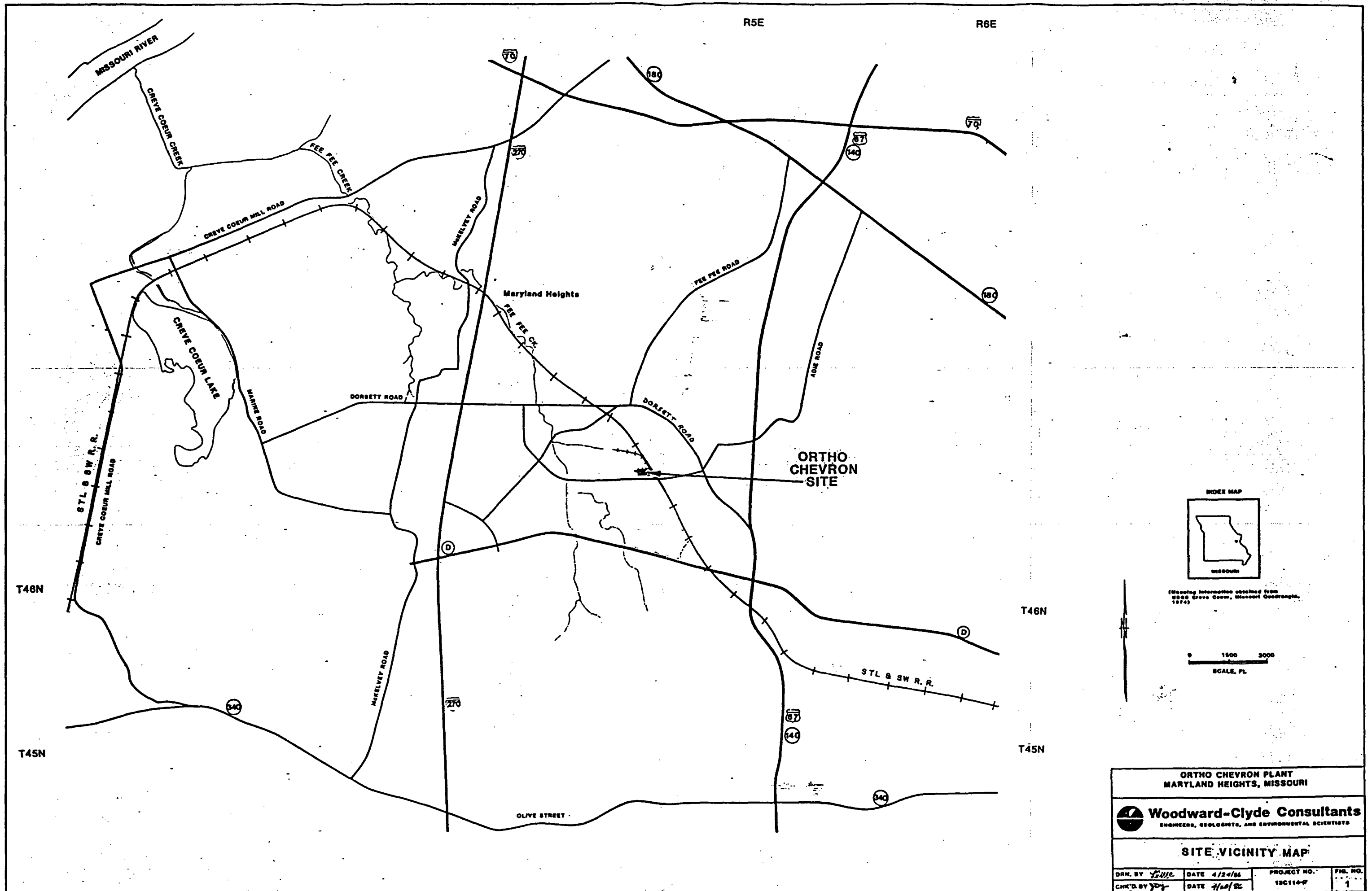
6/2/87
Date

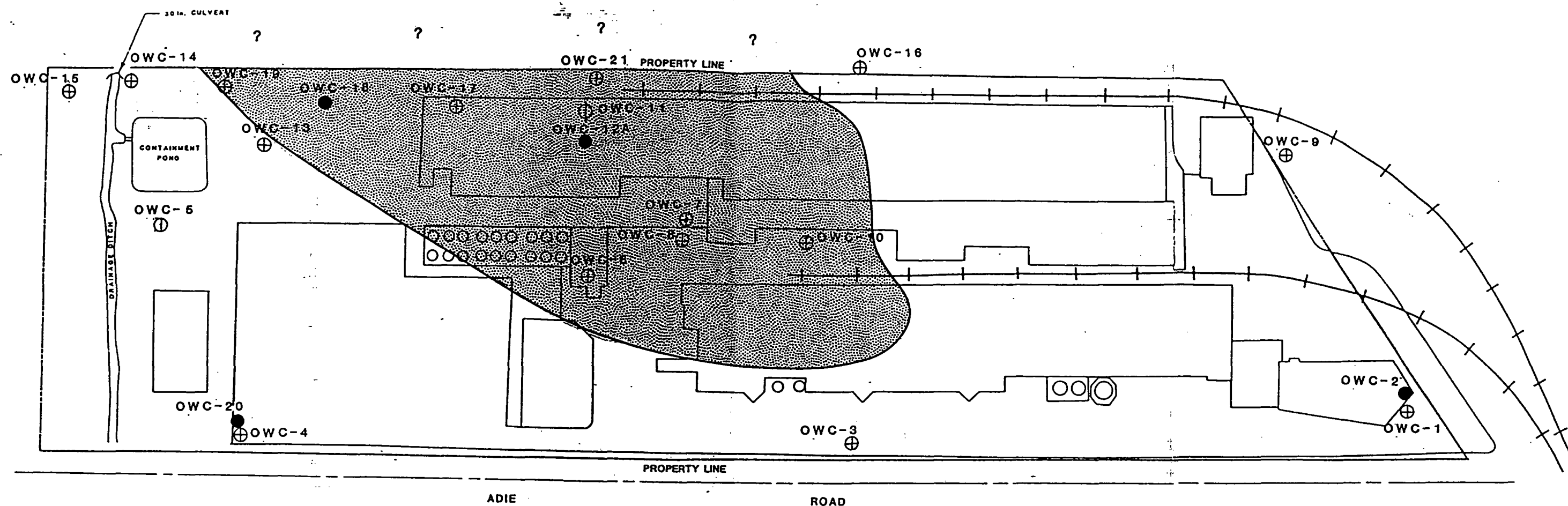
12.0 COMPLIANCE AGREEMENT

I, _____, have read the Health and Safety Plan for the Ortho-Chevron Plant, Maryland Heights, Missouri, dated _____. I hereby agree to abide by its provisions and to aid the Site Safety Officer in its implementation. I understand that it is in my best interest to see that site operations are conducted in the safest manner possible; therefore, I will be alert to site health and safety conditions at all times.

Signature

Date






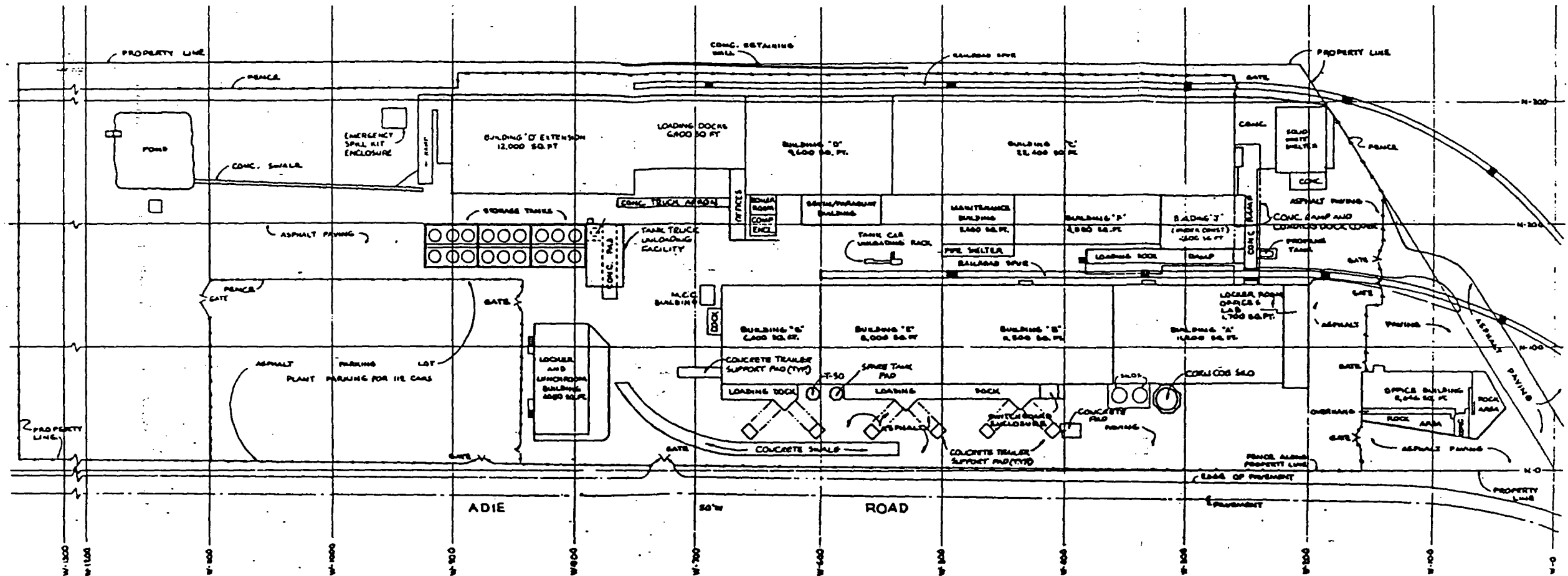
LEGEND

- OWC-1 ⊕ MONITORING WELL LOCATION AND NUMBER
- DEEP MONITORING WELL
- ⊖ INACTIVE MONITORING WELL
- ESTIMATED EXTENT OF ON-SITE GROUND WATER CONTAMINATION

? NOTE: EXTENT OF OFF-SITE GROUND WATER CONTAMINATION IS UNKNOWN.



ORTHO CHEVRON PLANT MARYLAND HEIGHTS, MISSOURI			
 Woodward-Clyde Consultants <small>ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS</small>			
ESTIMATED EXTENT OF ON-SITE CONTAMINATION			
DRN. BY <i>SMC</i>	DATE 2/6/87	PROJECT NO. 13C114-17	FIG. NO. 2
CHK'D BY <i>SMC</i>	DATE 2/8/87		



SCALE: 1 In. = 125 Ft.

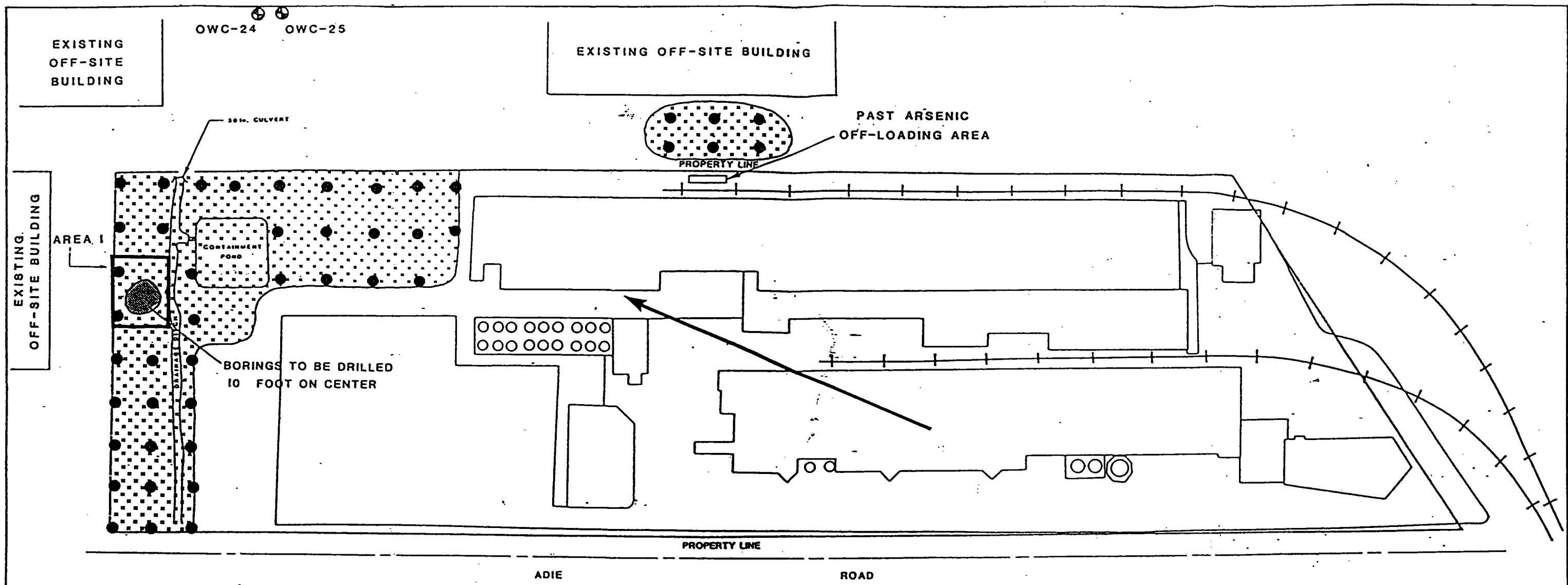
ORTHO CHEVRON
MARYLAND HEIGHTS, MISSOURI



Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

SITE PLAN

DRN. BY <i>JMC</i>	DATE 4/9/86	PROJECT NO. 13C114-7	FIG. NO. 3
CHK'D BY	DATE		



LEGEND

- OWC-24
● PROPOSED MONITORING WELL
- PROPOSED SOIL SAMPLING AREAS
- SUSPECTED MANEB BURIAL AREA
- ← APPROXIMATE FLOW DIRECTION OF SHALLOW GROUND WATER
- PROPOSED SOIL BORING/ SOIL SAMPLE LOCATIONS

0 50 100
SCALE, FT.

ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI

Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

PROPOSED FIELD INVESTIGATIONS

DRN. BY 97	DATE 6-22-86	PROJECT NO.	FIG. NO.
CHK'D BY JBM	DATE 6-23-86	13C114-17	4

APPENDIX A

TABLE A-1

SOIL SAMPLE ANALYTICAL DATA SUMMARY - PHASE 1
(concentrations are in ug/g)

<u>Compound</u>	<u>CHV-S-01</u>	<u>CHV-S-02</u>	<u>CHV-S-03</u>	<u>CHV-S-04A</u>	<u>CHV-S-04B</u>	<u>CHV-S-05</u>	<u>CHV-S-06</u>
4,4'-DDD	21.0	18.0	ND(2)	440.0	ND(2)	35.0	62.0
4,4'-DDE	10.0	6.0	ND(2)	26.0	ND(2)	7.0	27.0
4,4'-DDT	37.0	8.0	ND(2)	1230.0	75.0	134.0	140.0
Aldrin	5.0	2.0	ND(2)	52.0	42.0	5.0	15.0
Chlordane	200.0	1000.0	2100.0	ND(2)	ND(2)	ND(2)	ND(2)
Dieldrin	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Heptachlor	5.0	6.0	180.0	ND(2)	ND(2)	ND(2)	ND(2)
Lindane	ND(2)	ND(2)	ND(2)	160.0	25.0	4.0	2.0
Toxaphene	ND(100)	ND(100)	ND(100)	ND(100)	500.0	ND(100)	ND(100)
Captan	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	16.0	ND(2)

Notes

1. Samples were taken on July 12, 1985.
2. All samples taken from 0 to 1 foot except CHV-S-04B which was taken from 1 to 2 feet.
3. ND indicates 'Not Detected' with the numbers in parenthesis denoting the detection limits.
4. The above table represents contaminants that were detected during this sampling period.

TABLE A-2
SOIL SAMPLE ANALYTICAL DATA SUMMARY - PHASE 2
(concentrations in ug/g)

Compound	CHV-S-07			CHV-S-08		
	A	B	C	A	B	C
4,4'-DDD	14.0	ND(2)	ND(2)	56.0	ND(2)	14.0
4,4'-DDE	6.0	ND(2)	ND(2)	25.0	ND(2)	8.0
4,4'-DDT	ND(2)	ND(2)	ND(2)	370.0	ND(2)	71.0
Aldrin	ND(2)	ND(2)	ND(2)	39.0	ND(2)	ND(2)
Chlordane	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Dieldrin	ND(2)	ND(2)	ND(2)	14.0	ND(2)	ND(2)
Hepachlor	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Lindane	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	3.0
Toxaphene	ND(100)	ND(100)	ND(100)	ND(100)	ND(100)	ND(100)
Captan	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)

Notes

1. Samples were taken on August 22, 1985.
2. Sampling intervals:
A = 0 - 1 foot
B = 1 - 2 feet
C = 2 - 3 feet
3. ND indicates "Not Detected" with the numbers in parenthesis denoting the detection limits.
4. The above table represents contaminants that were detected during this sampling period.

TABLE A-2 (continued)
SOIL SAMPLE ANALYTICAL DATA SUMMARY - PHASE 2
(concentrations in ug/g)

Name	CHV-S-09			CHV-S-10		
	A	B	C	A	B	C
4,4'-DDD	19.0	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
4,4'-DDE	100.0	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
4,4'-DDT	120.0	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Aldrin	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Chlordane	ND(2)	ND(2)	ND(2)	140.0	ND(2)	76.0
Dieldrin	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Heptachlor	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Lindane	18.0	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Toxaphene	5200.0	ND(100)	ND(100)	ND(100)	ND(100)	ND(100)
Captan	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)

Notes

1. Samples were taken on August 22, 1985.
2. Sampling intervals:
A = 0 - 1 foot
B = 1 - 2 feet
C = 2 - 3 feet
3. ND indicates "Not Detected" with the numbers in parenthesis denoting detection limits.
4. The above table represents contaminants that were detected during this sampling period.

TABLE A-2 (continued)
SOIL SAMPLE ANALYTICAL DATA SUMMARY - PHASE 2
(concentrations in ug/g)

Name	CHV-S-11			CHV-S-12		
	A	B	C	A	B	C
4,4'-DDD	5.5	ND(2)	2.8	ND(2)	ND(2)	ND(2)
4,4'-DDE	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
4,4'-DDT	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Aldrin	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Chlordane	940.0	130.0	590.0	31.0	ND(2)	ND(2)
Dieldrin	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Hepachlor	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Lindane	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)
Toxaphene	ND(100)	ND(100)	ND(100)	ND(100)	ND(100)	ND(100)
Captan	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)	ND(2)

Notes

1. Samples were taken on August 22, 1985.
2. Sampling intervals:
A = 0 - 1 foot
B = 1 - 2 feet
C = 2 - 3 feet
3. ND indicates "Not Detected" with the numbers in parenthesis denoting detection limits.
4. The above table represents contaminants that were detected during this sampling period.

APPENDIX B

OPERATING PROCEDURE NO. HS-102

102.0 Heat Stress

102.1 Purpose

The purpose of this OP is to provide general information on heat stress and the methods that can be utilized to prevent or minimize the occurrence of heat stress.

Adverse climatic conditions are important considerations in planning and conducting site operations. Ambient temperature effects can include physical discomfort, reduced efficiency, personal injury, and increased accident probability. Heat stress is of particular concern while wearing impermeable protective garments, since these garments inhibit evaporative body cooling.

102.2 Requirements

The NIOSH criteria document for heat stress recommends that environmental monitoring and other preventive measures be adopted in hot work environments. However, the provisions are not directly applicable to employees who are required to wear impermeable protective clothing. The reason for this exception is that impermeable clothing prevents the evaporation of sweat, which is one of the most important cooling mechanisms of the body. There is no recognized health standard protection for workers wearing impermeable protective clothing and respirators in hot environments.

The ACGIH has adopted a TLV for heat stress. These guides relate to work/rest regimes.

102.3 Additional Hazard

The use of Personal Protective Equipment of the types commonly used for hazardous waste work can place stress on the body. One common problem with the use of personal protective equipment especially in hot environments is heat stress. Protective clothing can cause excessive sweating and can prevent the body from properly regulating body temperature.

102.4 Types of Heat Stress

Heat stress is the aggregate of environmental and physical work factors that constitute the total heat load imposed on the body. The environmental factors of heat stress are the air temperature, radiant heat exchange, air movement, and water vapor pressure. Physical work contributes to the total heat stress of the job by producing metabolic heat in the body in proportion to the intensity of the work. The amount and type of clothing also affect the heat stress.

Heat strain is the series of physiological responses to heat stress. When the strain is excessive for the exposed individual, a feeling of discomfort or distress may result, and, finally, a heat disorder may ensue. The severity of strain will depend not only on the magnitude of the prevailing stress, but also on the age, physical fitness, degree of acclimatization, and dehydration of the worker.

Heat disorder is a general term used to describe one or more of the following heat-related disabilities or illnesses:

- Heat cramps - painful intermittent spasms of the voluntary muscles following hard physical work in a hot environment. Cramps usually occur after heavy sweating, and often begin at the end of a work shift.
- Heat exhaustion - profuse sweating, weakness, rapid pulse, dizziness, nausea, and headache. The skin is cool and sometimes pale and

clammy with sweat. Body temperature is normal or subnormal. Nausea, vomiting, and unconsciousness may occur.

- Heat stroke - sweating is diminished or absent. The skin is hot, dry, and flushed. Increased body temperature, which, if uncontrolled, may lead to delirium, convulsions, coma, and even death. Medical care is urgently needed.

102.5 Methods of Controlling Heat Stress

As many of the following control measures as are appropriate to site conditions should be utilized to aid in controlling heat stress:

- Provide for adequate liquids to replace lost body fluids and replace water and salt lost from sweating. Encourage personnel to drink more than the amount required to satisfy thirst. Thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement.
- Replace fluids with water, commercial mixes such as Gatorade or Quick Kick, or a combination of these.
- Establish a work regimen that will provide adequate rest periods for cooling down. This may require additional shifts of workers.
- Wear cooling devices such as vortex tubes or cooling vests beneath protective garments.
- Take all breaks in a cool rest area (77°F is best).
- Remove impermeable protective garments during rest periods.
- Do not assign other tasks to personnel during rest periods.
- Inform personnel of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

102.6 Monitoring

102.6.1 Temperature

The heat stress of an area can be monitored by the Wet Bulb Globe Temperature Index (WBGT) technique. Where heat stress monitoring is required, a heat stress monitoring device, such as the Wibget Heat Stress Monitor (Reuter Stokes) shall be utilized.

The WBGT shall be compared to the Threshold Limit Values (TLV) outlined by the ACGIH TLV guides, and a work-rest regimen shall be established in accordance with the WBGT. Note that 5°C must be subtracted from the TLVs for heat stress listed to compensate for the wearing of impermeable protective clothing.

102.6.2 Medical

In addition to the provisions of the WCC medical surveillance program, on-site medical monitoring of personnel shall be performed by qualified medical personnel for projects where heat stress is a major concern. Blood pressure, pulse, body temperature (oral), and body weight should be taken and recorded a minimum of three times daily (prior to work, at mid-shift, and after work).

102.4 References

American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances in the Work Environment, 1984-95.

Olishifski, J.B., Fundamentals of Industrial Hygiene, National Safety Council, 1983.

National Institute for Occupational Safety and Health, The Industrial Environment - Its Evaluation and Control, 1973.

SAMPLING PLAN
ORTHO-CHEVRON CHEMICAL PLANT
MARYLAND HEIGHTS, MISSOURI

APPENDIX 3

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Figure 4 - Suspected Maneb Burial Area

1.0 INTRODUCTION AND SITE DESCRIPTION

The U.S. Environmental Protection Agency (USEPA) has requested Chevron Chemical Company and its consultant, Woodward-Clyde Consultants, to submit a work plan addressing certain past waste management practices at Chevron Chemical Company's facility in Maryland Heights, Missouri. Chevron Chemical Company and Woodward-Clyde Consultants have developed a work plan to address and guide the proposed studies at the Maryland Heights, Missouri facility. This sampling plan defines the procedures to be implemented during the field sampling activities at the facility.

Planned field activities include the installation of off-site ground water monitoring wells, shallow soil sampling, and on-site and off-site ground water sampling and analyses.

1.1 SITE DESCRIPTION

The Ortho-Chevron Plant is located in an established industrial area along Adie road in Maryland Heights, Missouri. The property is approximately 15 miles west of the greater St. Louis area in the southwest quarter of Section 23, Township 46 North, Range 5 East (Figures 1 and 2). The site lies within the Fee Fee Creek watershed which ultimately drains into the Missouri River 5 miles to the northwest. The site is rectangular (approximately 1300 feet by 325 feet) with the long axis oriented east-west with two series of production buildings located adjacent to two rail spurs (Figure 3). A detailed description of the site and vicinity is presented in the work plan.

1.2 PREVIOUS SITE INVESTIGATIONS

In 1981, Chevron Chemical Company initiated geohydrological investigations at the Maryland Heights site. Soil and ground water monitoring activities have also been implemented. Investigations have included installation and

sampling of ground water monitoring wells, exploratory borings, and shallow soil borings.

Previous on-site and off-site activities have been reported and/or referenced in the June 1986, Site Characterization Report or in the Work Plan.

2.0 SAMPLING METHODOLOGIES

2.1 ON-SITE ACTIVITIES

The proposed on-site activities include the continuation of the quarterly ground water sampling and the drilling and sampling of several shallow borings at the far west end of the site. Details of the procedures to be implemented are presented below.

2.1.1 GROUND WATER SAMPLING

2.1.1.1 Objective and Scope

Monitoring wells (OWC-) 1, 12A, 14, 15, 16, 17, 18, 19 and 20 will be sampled and analyzed on a quarterly basis for the period covered by the Work Plan as part of the ongoing quarterly monitoring program. A new ground water monitoring plan will then be developed, if appropriate. Samples from wells will be analyzed for total xylenes, arsenic, and selected pesticides (Table 1). These analyses will be used in evaluating migration of contaminants in the site area.

2.1.1.2 Equipment

A list of field ground water sampling equipment needed for the project is presented in Table 2.

2.1.1.3 Procedure

The procedures that will be used to collect ground water samples are as follows:

- (1) Check the well for above-ground damage.
- (2) Remove the well cap.

- (3) Monitor the air quality at the well head and record the measurements.
- (4) Prior to sampling, measure and record from the top of the inner casing the casing radius (ft), total depth of well (ft), depth to water (ft). Calculate the height of water column (ft) and standing volume (gallons) of water in the well. Decontaminate tools prior to measuring and after measurements are taken.
- (5) Purge the well by removing the equivalent of three to five well volumes of water, recording the actual volume of water removed. After each well volume is removed, a grab sample may be obtained for pH and specific conductivity analysis. The exact amount of purging will be determined in the field on the basis of geological and/or hydrological conditions and on well construction detail. Water purged from the wells will be disposed of by discharging the bailer of water on the ground surface.
- (6) In the event that a submersible pump may be used to purge any wells, rinse the submersible pump with clean distilled water, rinse with reagent-grade Alconox and rerinse with deionized water. All decontaminated equipment as such must be stored on clean polyethylene sheeting and should not touch the ground adjacent to the well.
- (7) Attach polypropylene security line securely to pump with bowline and clamp.
- (8) Lower the pump assembly to a depth which results in the pump intake being located no less than 10 feet below the top of the water column.
- (9) Record time and start pump. The water column height will be monitored to ensure that the intake remains below the top of the water column.
- (10) Remove the pump assembly from the well. The pump will be decontaminated after removal in preparation for subsequent well development by rinsing the pump with clean distilled water, rinsing with reagent-grade Alconox, followed by a final rinse with deionized water.
- (11) In the event that a bailer is being used to purge the well, don a clean pair of surgical gloves, remove a decontaminated 1 1/2-inch I.D. X 30" Teflon or stainless steel bailer and check-valve from the wrapping and screw the check-valve into the bottom of the bailer.

- (12) Attach polypropylene line securely to bailer with bowline and play out enough line to submerge the bailer. Care will be taken to ensure that the polypropylene line does not touch the ground.
- (13) Bailers of water will be used to fill the sample containers. Sample vials for volatile organic compounds (VOC's) will be filled first. To help avoid any potential constituent stratification in the water sample from affecting the representative nature of the samples, each remaining sample container will be filled by pouring a small portion into each container alternately until all of the remaining containers are filled. Split samples will be obtained if requested by the EPA. Sample size and sample container sizes and types are detailed in the site QA/QC Plan (Appendix 4 to the Work Plan).
- (14) Ground water samples designated for dissolved metals analysis will be filtered in the field using a 0.45-micron cellulose acetate filter. Disposable filter units will be used to minimize the potential for cross contamination.
- (15) Pour bailer contents into a clean container for temperature, pH, salinity and specific conductance measurements. Decontaminate the container between uses.
- (16) Decontaminate the exterior of all sample bottles prior to packing for shipment. Log and package all sample bottles in their respective coolers, add ice and packing material as necessary, and seal for shipment.
- (17) Lock the wells.
- (18) Dispose of gloves, polyethylene sheet and bailer lines into plastic bags and leave with Chevron for proper disposal. Decontaminate bailer by rinsing with reagent grade alconox and following with deionized water rinse.
- (19) Ship samples under Chain-of-Custody to Wilson Laboratories, Salina, Kansas, by overnight delivery service (Federal Express).

2.1.1.4 Documentation

Certain records will be maintained in field logbooks during ground water sampling activities. The field logbooks will be numbered and properly identified with the project name, location, and WCC project number on the cover. These records include but are not limited to the following:

- o Date/time/weather conditions
- o Well number
- o Names of samplers and any observers
- o Any visible well damage
- o Water level before purging
- o Total depth of casing
- o Calculated and actual water volume evacuated from well
- o Time begin purge
- o Color and notation of any changes
- o Time end purge
- o Water level after purging
- o Time sample taken, method or procedure used to obtain samples
- o Temperature of water, °C
- o Specific conductivity (umhos/cm)
- o pH
- o pH meter check
- o Whether sample was preserved and/or filtered
- o Other information as required (shipping information, etc.)
- o Comments (deviation from sampling plan, etc.)

2.1.1.5 Decontamination

Decontamination of equipment is presented in Section 2.1.1.3.

Decontamination of personnel is presented in the Health and Safety Plan.

2.1.1.6 Environmental Monitoring

Environmental monitoring will be performed with either a Century System Organic Vapor Analyzer (OVA) or the HNu photoionization detector (11.7 eV source) operated in a survey mode. During ground water sampling, monitoring will be conducted both at the well head and in the breathing zone. All organic vapor monitoring readings will be recorded in a site log-book dedicated to documentation of procedures, environmental monitoring data, and sample collection information.

Groundwater sampling will be initiated in modified Level D. Upgrades from this initial level to Level C protection (and subsequent return to Level D) may be authorized by the Site Safety Officer SSO based on environmental conditions.

In the event an upgrade to Level C becomes necessary, work may proceed under Level C protection until the organic vapor concentrations in the breathing zone exceed 10 ppm above ambient levels. In this event, work will stop pending assessment and evaluation by the Project Safety Officer and/or the Woodward-Clyde Consultants (WCC) Health and Safety Officer (HSO). Because of the nature of the proposed activities, and the detected levels of contaminants, it is not anticipated that this situation will be encountered.

2.1.2 SHALLOW SOIL SAMPLING

2.1.2.1 Objective and Scope

A shallow subsurface investigation will be initiated in the western portion of the site. The information obtained from interviewing past and present personnel indicate that past disposal of Maneb fungicide may have occurred in this area. The primary objective of this investigation will be to evaluate the extent and concentration levels of buried Maneb fungicide and

its primary degradation products in this area. Borings within the suspected Maneb burial areas will be spaced on 10-foot centers and will be continuously sampled to a total depth of 6 feet. Each 18-inch sampled interval will be composited and a representative sample obtained. Additional borings will be located in the remainder of the western portion of the site outside of the suspected Maneb burial locations (Figure 4). These will be placed on 40-foot centers and will also be sampled to a depth of six feet. One overall composite sample will be retained for chemical analysis.

Based on information obtained from interviews of past and present plant personnel on areas of suspected Maneb burial, it is estimated that the proposed borings will be sufficient to characterize the area.

2.1.2.2 Equipment

A list of the field sampling equipment needed for field soils sampling is presented in Table 3.

2.1.2.3 Procedures

The following procedures will be followed to obtain the desired soil samples for chemical analyses:

- 1) The actual boring locations will be taped from permanent structures and identified on the base map. Elevations of boreholes will be estimated based on the elevations of known structures.
- 2) Surface vegetation will be cleared from the locations designated for sample collection.
- 3) An HNU/OVA reading will be taken and recored at the borehole location and in the breathing zone.
- 4) All drilling equipment will be decontaminated prior to site entry.

- 5) The drill rig and assorted drilling tools will be decontaminated by steam cleaning prior to any drilling, between boring locations, and at the end of the work using the following procedure:

- o Steam cleaned with soap and water, and
- o Rinsed with potable water.

The sample equipment and any tools that will come in contact with the samples will be decontaminated and steam cleaned prior to sampling, between the sampling intervals, between boring locations, and at the end of the work using the following procedure:

- o Rinse with potable water (steam clean); and
- o Rinse with reagent-grade Alconox and rerinse with deionized water.

- 6) All decontaminated equipment will be stored on clean polyethylene sheeting and should not touch the ground adjacent to the boring.
- 7) A split-spoon sampler will be driven (standard penetration resistance) 18 inches into the ground and the sampler will be withdrawn. The sampler will be opened, and the samples will be measured, photographed, visually identified, and then composited in a stainless steel pan and placed in the appropriate containers. The augers will then be advanced to a depth of 18 inches.
- 8) All sampling equipment will be decontaminated following the procedure outlined in Step 5 before deeper samples are taken.
- 9) Repeat the sampling, boring, and decontamination procedure for the entire depth of the borehole, as specified by the Site Field Coordinator.
- 10) Log and package all sample bottles in their respective coolers, add ice and packing materials, as necessary, and seal for shipment.
- 11) Ship samples under Chain-of-Custody to Wilson Laboratories in Salina, Kansas for analysis.

2.1.2.4 Documentation

A field book dedicated to this activity will be kept during all phases of soil sampling, recording (at a minimum) the following information:

- o Project name and number
- o Date/Time/Weather
- o Personnel present
- o Boring location (taped from a nearby permanent structure)
- o Sample number
- o Estimated elevation
- o Total depth of boring
- o Visual description
- o Type of sample
- o Recovery
- o Resistance
- o Photo number
- o Other information as required

The pages will be numbered sequentially and all entries will be made in ink.

2.1.2.5 Decontamination

Decontamination of drilling and sampling equipment will be required. The decontamination effort for the drilling equipment will be subdivided into two phases. The first phase, prior to site entry, will consist of a thorough cleaning of the rear portion of the drill rig, drill rods, augers, bits, threads, sampling equipment, and other associated equipment. This cleaning will consist of a preliminary rinse using high-pressure potable water to remove encrusted soils, oil, and grease. The equipment and associated materials will then be steam washed with detergent and potable water and then rinsed with potable water.

The second phase of the decontamination process will be the cleaning of all drilling and sampling equipment between boreholes or sample locations as well as all well material prior to installation. All drilling or sampling equipment will be rinsed with high-pressure potable water and detergent to

remove mud and contaminants and then steam rinsed with potable water. Hot water (210°F) may be used in lieu of steam during decontamination. Care will be exercised by all personnel involved to prevent cross contamination of boreholes, samples, or monitoring wells. The decontamination of all drilling and sampling tools and equipment will be conducted at a decontamination station identified during site mobilization.

2.1.2.6 Environmental Monitoring

Air quality surveys will be conducted using an HNu photoionization detector (11.7 eV source), or a Century Systems Organic Vapor Analyzer (OVA) operated in the survey mode. Monitoring will be conducted upwind of the sampling location or survey area to establish ambient background levels of organic vapors prior to monitoring in the work area.

During any intrusive work, monitoring will be conducted at the borehole and in the breathing zone. All organic vapor monitoring readings will be recorded in a site log book dedicated to documentation of procedures, environmental monitoring data, and sample collection information.

A detailed presentation of environmental monitoring is included in the Site Health and Safety Plan.

2.2 OFF-SITE ACTIVITIES

2.2.1 SHALLOW SOIL SAMPLING

2.2.1.1 Objective and Scope

Six shallow soil borings are proposed to be drilled to a depth of 6 feet off-site north of the northern most railroad spur. The locations of these borings may be modified slightly due to accessibility and additional historical data. Composite samples from each 24-inch interval from these

borings will be analyzed for arsenic in order to evaluate the possibility of wind-blown or surface water born migration of arsenic from the old off-loading area.

2.2.1.2 Equipment

The field equipment needed for the shallow soil sampling is listed in Table 3.

2.2.1.3 Procedures

The procedures used for these shallow samples is the same as noted in Section 2.1.2.3. The estimated depth of borings in these locations is six feet.

2.2.1.4 Documentation

The documentation requirements are listed in Section 2.1.2.4.

2.2.1.5 Decontamination Procedures

The decontamination procedures are the same as those presented in Section 2.1.2.5.

2.2.1.6 Environmental Monitoring

The environmental monitoring needs are listed in Section 2.1.2.6.

2.2.2 MONITORING WELL INSTALLATION

2.2.2.1 Monitoring Well Locations

Presently, an off-site monitoring well cluster location is proposed which appears to be down gradient of the site and consists of one pair of nested

wells. OWC-24 as proposed will be screened in the shallow water bearing unit and OWC-25 as proposed will be screened in the bedrock. The location of a second off-site monitoring well cluster will be based on the results obtained from the first off-site monitoring well cluster and from the off-site well survey.

The actual location of these wells will be selected based on information obtained from the off-site well survey and comments of the EPA. The need for the installation of additional wells at other locations will be evaluated, if necessary.

2.2.2.2 Equipment

The field equipment needs are presented in Table 3.

2.2.2.3 Procedures

Shallow borings to be completed as observation wells will be advanced with a nominal 8-inch-diameter continuous-flight hollow stem auger to the selected well depth. As the auger penetrates downward, the geologist or engineer will note changes in the types of soils encountered and the depths they are penetrated. Geotechnical samples will be collected with a split spoon sampler at five (5) foot intervals and at observed strata changes.

Deep borings to be completed as monitoring wells will be advanced by nominal 12-inch-diameter air rotary methods to the top of bedrock. Eight-inch diameter flush jointed PVC casing will be set and the annular space sealed and grouted to the ground surface. The boring will be continued into bedrock with 6-inch-diameter core barrel to a depth of approximately 60 feet. This section will then be reamed with a nominal 8-inch roller bit to total depth.

While the boring is being drilled, the slotted 4-inch PVC well screen sections and the solid 4-inch PVC riser pipe sections will be assembled. A PVC plug will be screwed into the bottom of the well screen. Each well will have a vented PVC cap. The pipe (previously decontaminated) will then be lowered by the drill rig into the boring immediately after the drilling equipment has been removed. Well-graded clean sand will be poured into the annular space around the well screen to a depth of approximately 2 feet above the top of the screen. Bentonite clay pellets will be poured into the annular space to form a 3-foot-thick minimum clay seal above the sand. A cement-bentonite grout will then be pumped into the annular space from the top of the bentonite-pellet seal to within approximately 2 feet of the surface.

Concrete will then be added to the remaining annular space and a 6-inch-diameter steel pipe (protective casing) will be placed over the well and set into the concrete. The concrete will act to hold the steel protective casing in place and will also act as a surface water seal.

Each protective casing will be provided with a drain hole drilled approximately 4 inches above the existing grade. A 1/4-inch-thick 2-inch-wide steel bar will be inserted into slots on either side of the protective casing or a hasped cover will be provided. A padlocked will be placed to prevent unauthorized entry to the wells.

Following monitoring well installation, each well will be developed by pumping, bailing, or other approved methods. Equipment used in well development procedures will be decontaminated appropriately. Well development will be initiated no sooner than 48 hours after the monitoring well installation is complete. A minimum of ten well volumes of formation waters will be evacuated from each well. Development of the wells will continue if required by the Site Manager. A record of the volume of water evacuated from each well will be made. Water extracted from the development of these wells will be collected and stored on site.

2.2.2.4 Documentation

The minimum documentation requirements are presented in Section 2.1.2.3.

2.2.2.5 Decontamination Procedures

Decontamination of drilling and sampling equipment is presented in Section 2.1.2.4.

2.2.2.6 Environmental Monitoring

The environmental monitoring procedures are outlined in Section 2.1.2.6.

2.2.3 GROUND WATER SAMPLING

2.2.3.1 Objective and Scope

Initial sampling of the off-site monitoring wells will be conducted within one week after completion of installation and development. The proposed off-site wells will be included in the quarterly samplings. A verification sampling and analysis will be performed approximately two (2) weeks after the initial sampling event at these wells. The initial and verification samples will be analyzed for selected organochlorine pesticides, phenoxyacid herbicides, arsenic and total xylenes (see Table 1).

2.2.3.2 Equipment

The necessary field sampling equipment is listed in Table 2.

2.2.3.3 Procedures

The ground water sampling procedures are outlined in Section 2.1.1.3.

2.2.3.4 Documentation

The documentation procedures are outlined in Section 2.1.1.4.

2.2.3.5 Decontamination

The decontamination procedures are outlined in Section 2.1.1.5.

2.2.3.6 Environmental Monitoring

The environmental monitoring procedures are outlined in Section 2.1.1.6.

TABLE 1
COMPOUNDS ANALYZED FOR IN GROUND WATER
MONITORING PROGRAM

<u>Volatile Organics</u>	<u>Pesticides (Herbicides)</u>	<u>Pesticides (Insecticides)</u>	<u>Metals</u>	<u>Field Measurements</u>
Total Xylenes	2,4-D 2,4,5-T	4,4-DDT 4,4-DDE 4,4-DDD Aldrin Dieldrin Chlordane Heptachlor Lindane Endrin Toxaphene	Arsenic	pH Specific Conductance Temperature

TABLE 2

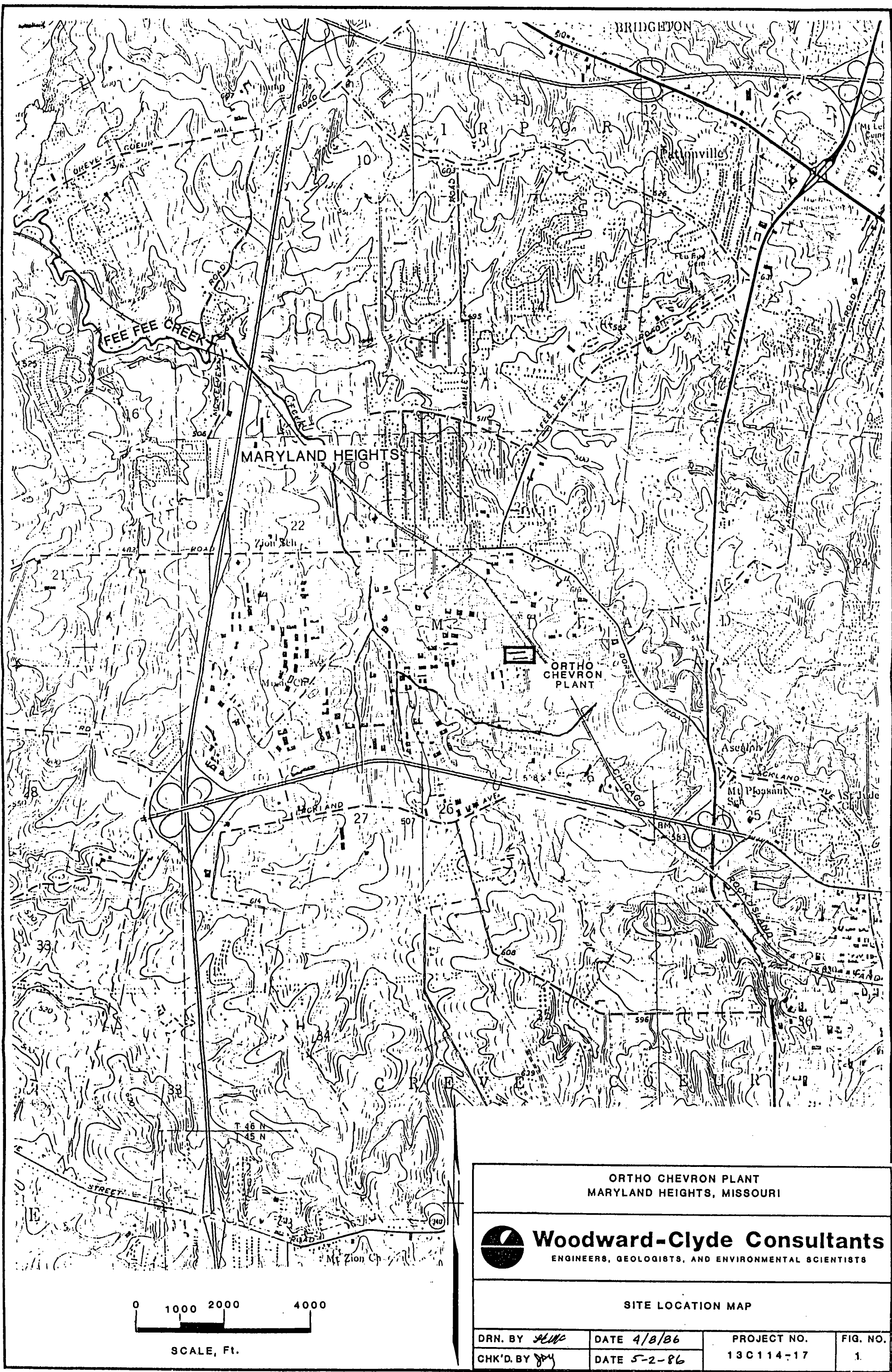
FIELD SAMPLING EQUIPMENT FOR GROUND WATER SAMPLING

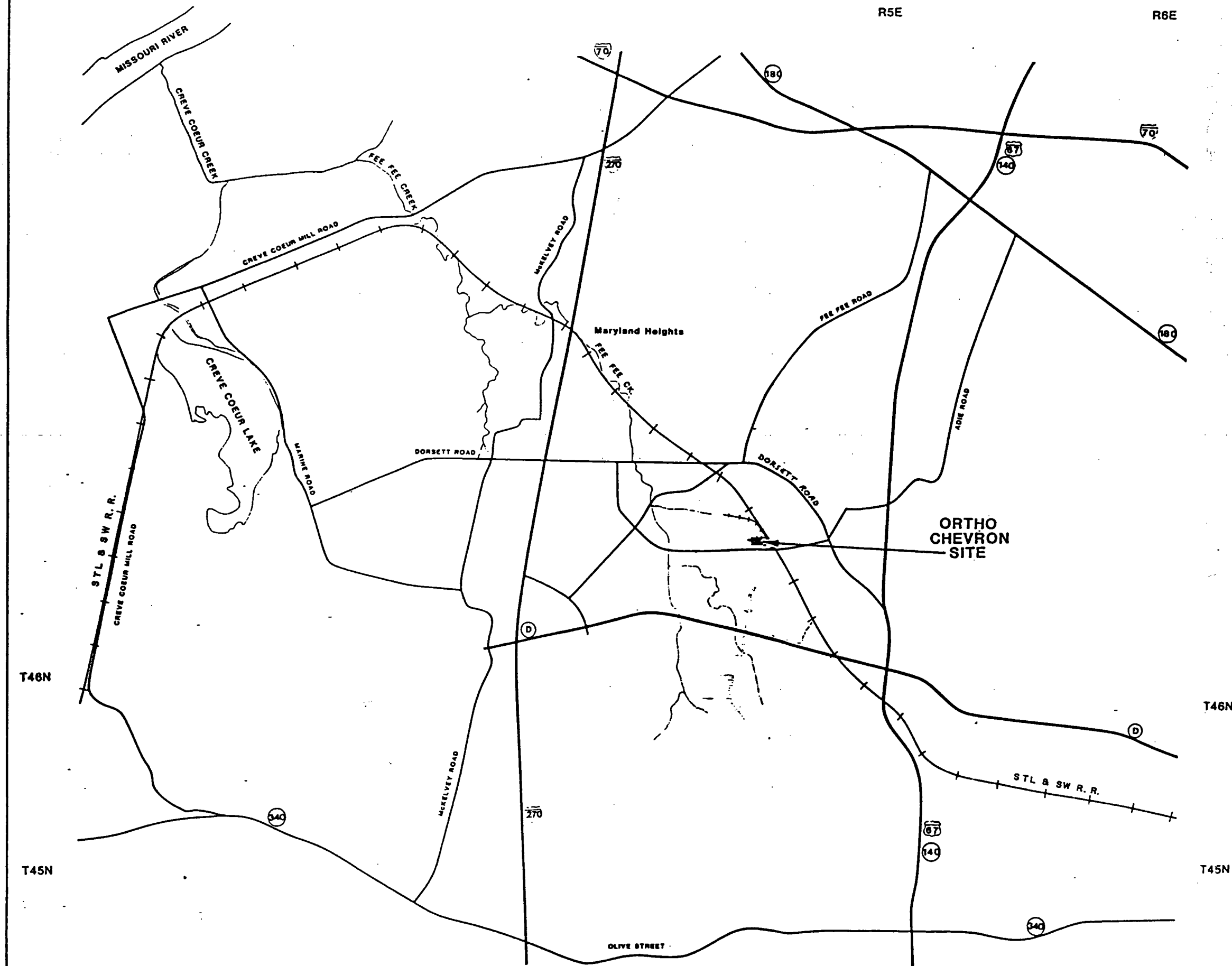
OVA or HNu (11.7 eV source)
Field log book
Sample coolers
Vermiculite/packing material
Ice
Paper towels/Handi-Wipes
Distilled water/de-ionized water
Laboratory bottles
Nitric acid
Sulfuric acid
Sodium hydroxide
pH meter
Specific conductivity/temperature/salinity meter
Beakers
pH buffer solution (4.0, 7.0)
Hand pump for filtering metals
Disposable filter units (0.45 micron pore size)
6-foot folding ruler
Strapping tape
Marking pens
Water level indicator
Polyethylene sheeting
Submersible pump (optional)
Bailer
Polypropylene rope

TABLE 3

FIELD SAMPLING EQUIPMENT FOR SOIL SAMPLING

Tape (100ft)
Sledge hammer, stakes, surveyors' flags
Level and survey rod
OVA or HNU
Shovel
Distilled water/de-ionized water
Field notebook
Camera and film (optional)
Plastic bags w/seal
Sample coolers
Ice
Hand towel
Stainless steel compositing pans
Vermiculite
Laboratory sample bottles
Paper towels/Handi-Wipes
6-ft folding wooden ruler
Drilling rig and associated tools
Split spoon samplers





(Mapping information obtained from
USGS Creve Coeur, Missouri Quadrangle,
1974)

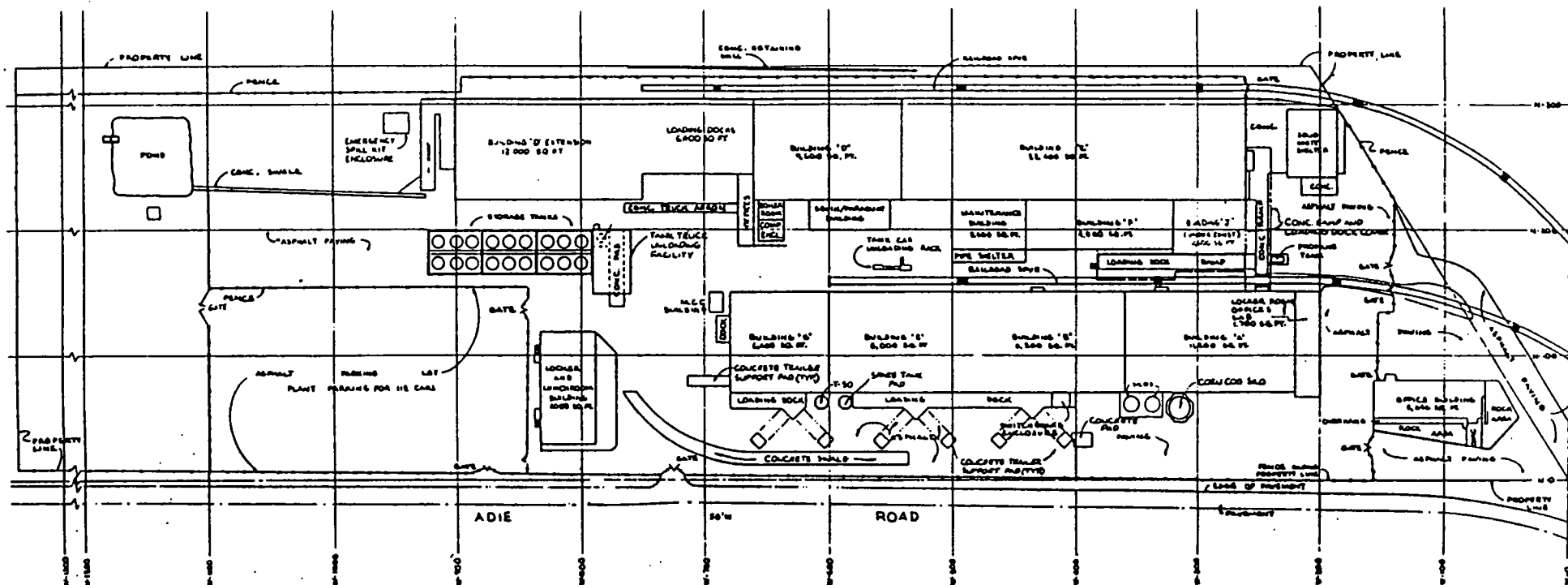
0 1500 3000
SCALE, FT.

ORTHO CHEVRON PLANT
MARYLAND HEIGHTS, MISSOURI

Woodward-Clyde Consultants
ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

SITE VICINITY MAP

DRN. BY <i>L.H.</i>	DATE <i>4/24/86</i>	PROJECT NO 13C114-B	FIG. NO. 2
CHK'D BY <i>Y.D.</i>	DATE <i>4/28/86</i>		



SCALE: 1 in. = 125 Ft.

ORTHO CHEVRON
MARYLAND HEIGHTS, MISSOURI

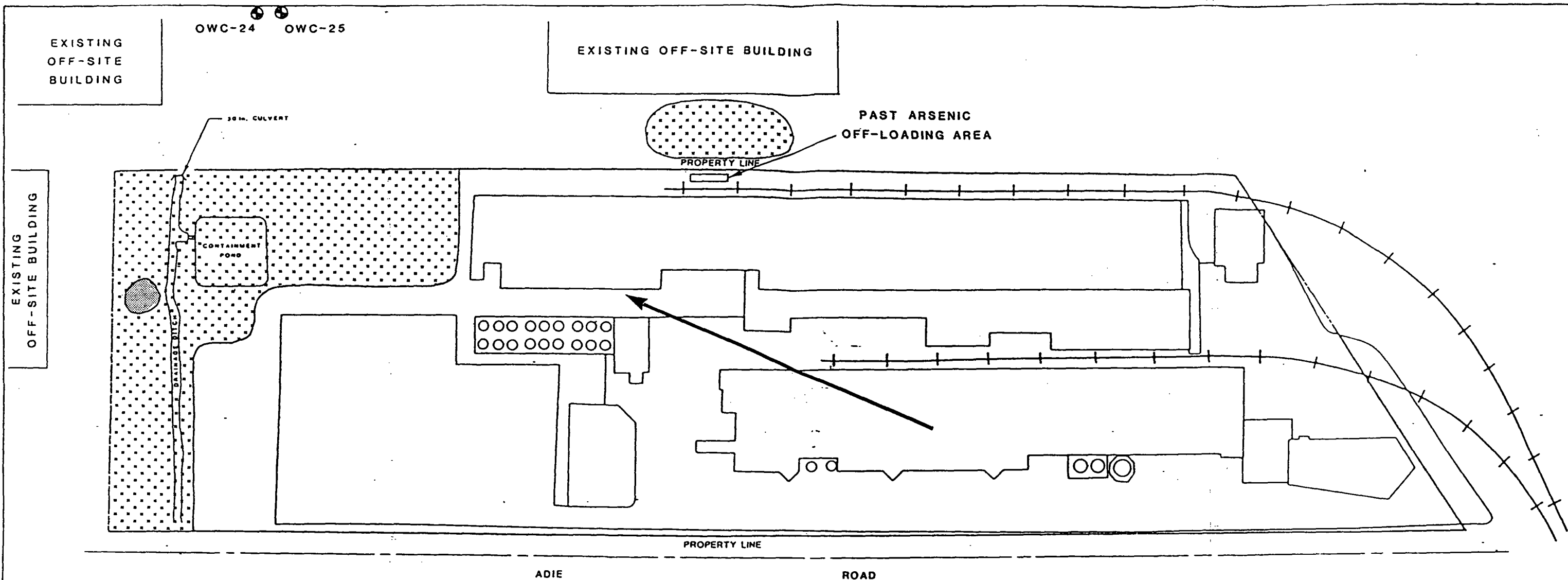


Woodward-Clyde Consultants

ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS

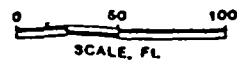
SITE PLAN

DRN. BY <i>JMC</i>	DATE 4/9/86	PROJECT NO. 13C114-7	FIG. NO. 3
CHK'D BY	DATE		



LEGEND

- OWC-24 PROPOSED MONITORING WELL
- PROPOSED SOIL SAMPLING AREAS
- SUSPECTED MANEB BURIAL AREA
- APPROXIMATE FLOW DIRECTION OF SHALLOW GROUND WATER



ORTHO CHEVRON PLANT MARYLAND HEIGHTS, MISSOURI			
Woodward-Clyde Consultants <small>ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS</small>			
SUSPECTED MANEB BURIAL AREA			
DRN. BY 97	DATE 6-22-86	PROJECT NO. 13C114-17	FIG. NO. 4
CHK'D BY JBY	DATE 6-23-86		

QUALITY ASSURANCE/QUALITY CONTROL PROJECT PLAN
ORTHO-CHEVRON CHEMICAL PLANT
MARYLAND HEIGHTS, MISSOURI FACILITY

APPENDIX 4

QUALITY ASSURANCE/QUALITY CONTROL PROJECT PLAN
ORTHO-CHEVRON CHEMICAL PLANT
MARYLAND HEIGHTS, MISSOURI

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1.0 PROJECT DESCRIPTION

1.1 Objectives

The Ortho-Chevron Plant is located in Maryland Heights, Missouri. The field activities at the site will include soil and ground water sampling.

The primary objectives of the Site Investigation at the Chevron Chemical Company facility in Maryland Heights, Missouri are as follows:

1. To better characterize the ground water quality beneath, and down gradient of the site.
2. To obtain information to characterize possible areas of contaminated materials burial on-site.
3. To identify and evaluate the potential for, and pathways of, off-site migration of contaminants.

The work tasks which comprise the site investigation to achieve these objectives are detailed in the Work Plan and the Site Sampling Plan. The objective of the Site QA/QC Plan is to outline procedures and responsibilities to ensure the quality of the project.

2.0 PROJECT SAMPLING PROGRAM

Ground water and soil sampling locations and frequencies are detailed in the Work Plan and Site Sampling Plan. Table 1 provides a tabulation of the proposed sampling program.

Ground water samples will be analyzed for the parameters listed in Table 2. Soil samples will be analyzed for the parameters in Table 3 with one exception. Soil samples obtained from the former arsenic off-loading area (18 total) will not be analyzed for Maneb or ethylene thiourea. Proposed sampling locations are depicted in Figure 1.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

All activities carried out under this project will be under the direction of the WCC Project Manager. Implementation of the QA/QC program will be the responsibility of the WCC QA/QC Officer. Quality assurance responsibilities involve monitoring and reviewing the procedures used to perform this project including sample collection, analytical services, data management, and report preparation. Ultimate responsibility for the project quality rests with the project manager. Specific quality assurance responsibilities are outlined below.

Sampling QC

The site manager's responsibilities will include maintenance of Chain-of-Custody on all samples collected, verification with sampling team personnel of sampling techniques and quality control procedures before every on-site activity. He will also be responsible for prompt review of any quality control deviation observed at the site.

Laboratory Analyses/QC

Cliff Baker (Wilson Laboratory). His responsibilities will include sample analyses on soil and ground water. He will also be responsible for quality control procedures and QC checks in the Wilson Laboratory for this project.

4.0 ANALYTICAL PROCEDURES

Chemical laboratory analyses of the soil and ground water samples will be performed by Wilson Laboratories, 525 North Eighth, Salina, Kansas. The laboratory has an extensive USEPA approved QA program (See Attachment A). The existing protocol of Wilson Laboratories is based upon the quality

assurance guideline provided in the following professional and governmental guidance documents:

1. "EPA Methods of Chemical Analysis of Water and Wastes," EPA-600/4-79-020, March 1983;
2. USEPA "Test Methods for Evaluating Solid Waste," SW-846; 2nd Edition, Volumes 1-7;
3. "NIOSH Manual of Analytical Methods, Methods for Analysis of AOAC;"
4. Annual Book of ASTM "Standards, Water", American Society for Testing and Materials; and
5. "Standard Methods" published jointly by the American Public Health Association (APHA), American Water Works Association (AWWA), and the Water Pollution Control Federation (WPCF).

Ground water samples will be analyzed for the parameters listed in Table 2. The analytical protocols to be used for ground water analysis will be EPA Methods 624, 608, and Standard Methods 16th Edition Method 509B (organics, pesticides, and herbicides). Metals (arsenic) will be analyzed using the appropriate protocols presented in EPA Publication 600/4-79-020 (See Table 6). Soil samples will be analyzed according to accepted protocol for soil matrix samples (See Table 7).

Maneb will be analyzed according to EPA Method 630. There is currently no accepted method for the analysis of Maneb in soil therefore EPA Method 630 will be modified. The modification will involve the addition of 50 grams of sample (soil) to a hydrolysis flask. The volume of the flask will then be brought to 1500 mL using reagent grade water and the pH maintained at less than 2. The remaining steps will be followed as outlined in Method 630. Detection limits for Maneb are not available at this time and will be set by the analytical lab.

Ethylene thiourea will be analyzed according to EPA Method 8140. It is anticipated that a detection limit of 1 mg/kg will be achievable in soil.

Samples will be preserved in accordance with those procedures established in Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983. Ground water samples for dissolved metals analysis will be field-filtered and preserved with nitric acid to a pH of less than 2.0. All other ground water samples will be preserved at a temperature of approximately 4°C and delivered to Wilson Laboratories via Federal Express the morning after they are collected. Soil samples will be stored at approximately 4°C and will be shipped to Wilson Laboratories within one week of collection.

To monitor analytical laboratory performance, field blank and duplicate samples (field QC) will be submitted with the samples collected in the field. The purpose of the field QC samples is to provide additional data to monitor the accuracy and repeatability of the laboratory analyses. The combined laboratory and field QC procedures will provide an adequate data base for evaluation of analytical data.

One blank ground water QC sample (prepared using deionized or distilled water) and one field duplicate will be submitted to the analytical laboratory for every ten ground water samples (i.e., 10 percent). One duplicate soil sample will be submitted to the analytical laboratory for every 10 soil samples.

A summary of the estimated number of samples to be analyzed by Wilson Laboratory is provided in Table 4.

5.0 DATA QUALITY REQUIREMENTS AND ASSESSMENTS

5.1 Data Representativeness

Data representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variation at a sampling point, a process condition, or an environmental

condition. To ensure that characteristic data is obtained, the following procedures will be implemented.

- o Monitoring wells will be purged of three to five casing volumes or until dry prior to obtaining samples to ensure that a representative sample has been obtained from the aquifers.
- o The subsurface soil samples will be obtained from the vertical depths in the soil column which are most likely to contain contaminants and the soil will be removed from the sampler and thoroughly mixed in a stainless steel pan to yield a composite of the sampled interval which will be containerized and submitted for analysis.

5.2 Data Comparability

Data comparability expresses the confidence with which one data set can be compared to one another. All aqueous sample data will be reported in ug/l (ppb). All soil samples will be reported in terms of mg/kg (ppm). Sampling protocol and procedures listed in the Site Sampling Plan will be strictly adhered to.

6.0 SAMPLING PROCEDURES

Sampling procedures are provided in the Site Sampling Plan (Appendix 3 to the Work Plan) and summarized in Section 3 of the Work Plan.

7.0 SAMPLE CUSTODY PROCEDURES

Sampling team personnel will perform all sampling activities and will retain custody of the samples until shipment to the laboratory. One Chain-of-Custody form (Figure 2) will be used for each shipping container (cooler).

Field activities will be recorded in the field log book at the time the activity is conducted. An outline of the requirements for field log book entries is given in the Site Sampling Plan. The following information will be recorded in the master sample log book used at this site:

- o Project name and number
- o Names of sampling personnel
- o Sample number
- o Sample location
- o Sample depth
- o Date and time of sample recovery
- o Sampling device
- o Method of sampling
- o Type of sample
- o Description of sample
- o Analysis parameters
- o Containers, shipping, preservatives
- o Destination (archive or analytical laboratory)
- o Date of shipment to laboratory
- o Shipper invoice number
- o Instrument calibration and field checks (page 6)

All log book pages will be sequentially numbered and all entries made in ink.

Any samples temporarily stored on-site will be placed in an on-site archive. The archive area will be locked to maintain security and the samples will be tracked under both the project Chain-of-Custody and the master sample log book.

Any soil samples that are stored in the archive will be maintained at a temperature of approximately 4° centigrade after recovery, with samples to be shipped in a timely manner so that analyses can be performed within the allotted EPA holding times presented in Table 7.

Wilson Laboratories will provide the project with all sample containers necessary for completing field sampling and QC requirements. Each lot of sample containers will be checked for cleanliness by the laboratory

and closed and sealed to prevent contamination. Prior to obtaining each individual sample, each bottle will be labeled by the field personnel to indicate sample number, location, time, date, and the analyses to be performed on the sample and any preservatives added. Following sample collection the sample containers will be packaged in a sealed plastic bag and placed into a sample cooler with packing material and ice, as appropriate, to prevent breakage. Chain-of-Custody forms, field blanks, custody seals, etc. will be added to each sample cooler as required by QA/QC procedures. The samples will be shipped to the analytical laboratory by overnight delivery service (Federal Express) under Chain-of-Custody protocol.

Samples will be received at the laboratory by the sample custodian who will examine each sample to ensure that it is the expected sample, inspect the sample containers for possible damage, and ensure that the documentation is complete and adequate. The sample custodian will ensure that each sample has been preserved in the manner required by the particular test to be conducted and stored and shipped according to the correct procedure.

Summaries indicating the sampling parameters and methods, sample collection summaries, and data quality objectives for soil and ground water matrices are presented in Tables 6 through 11.

8.0 CALIBRATION PROCEDURES AND PREVENTIVE MAINTENANCE

A maintenance, calibration, and operation program will be implemented to ensure that routine calibration and maintenance is performed on all field instruments. The program will be administered by the site manager and the team members. The site manager will perform the scheduled monthly and annual equipment calibration and maintenance; and trained staff members will perform field calibrations, checks and instrument maintenance prior to use. Table 5 presents the maintenance schedules for instruments to be used specifically on this project.

Team members will be familiar with the field calibration, operation, and maintenance of the equipment, maintain proficiency and will perform the prescribed field operating procedures outlined in the Operation and Field Manuals accompanying the respective instruments. They will keep records of all field instrument calibrations and field checks in the field log books. If on-site safety monitoring equipment should fail, the Site Safety Officer or site manager will be contacted immediately. He will either provide replacement equipment or have the malfunctioning equipment repaired immediately.

The laboratory QA Officer will oversee the calibration and maintenance of the laboratory analytical instruments. Wilson Laboratories' QA/QC Plan (Attachment A to this plan) outlines the procedures that will be followed.

9.0 DOCUMENTATION, DATA VALIDATION, AND REPORTING

9.1 Documentation

Field sheets, lab sheets, sample labels, and/or field notebooks will carry the following information pertaining to sample I.D.:

- o Sample identification number
- o Site identification
- o Sample location
- o Date and time of sample collection
- o Name of person collecting the sample
- o Analyses to be performed

All field data will be entered into bound notebooks. Field notebooks, Chain-of-Custody forms, field data sheets, and lab reports will be filed and stored at WCC Offices, 5055 Antioch Road, Overland Park, Kansas.

9.2 Data Validation

The precision of the laboratory data will be checked by comparison of the analytical results with the QC samples. The data validity will also be assessed by comparison of blanks, duplicates, replicates, and upgradient samples with downgradient and on-site samples. If analyzed parameters are detected in the blanks, the parameter data point will be invalidated.

The laboratory will critique its own analytical program by the use of spiked addition recoveries, established detection limits for each matrix, precision and accuracy control charts, and accurate records of instrument calibrations. Wilson Laboratories establishes average recoveries for surrogates over time, standard deviations and control and warning limits. When a sample recovery is outside the control limit, the sample analysis is repeated. If upon repetition the sample recovery remains outside the control limits, the sample will be deemed unsuitable for the method and no further analysis will be conducted on the sample. Data validation will be the responsibility of Woodward-Clyde Consultants in conjunction with the Wilson Laboratories QA Officer.

9.3 Reporting

Data will be reported in a site investigation report prepared by Woodward-Clyde Consultants. Data reported will include all laboratory analytical results for soil and ground water, including quality assurance samples. The results of the ground water use survey in the area of the facility will also be provided and the suitability of the wells for sampling will be evaluated. Boring logs, geophysical survey results and downhole geophysical logs will also be included.

TABLE 1
PROPOSED SAMPLING PROGRAM
GROUND WATER

<u>Existing Wells¹</u>	<u>New Wells²</u>
OWC - 1	OWC - 24
OWC - 12A	OWC - 25
OWC - 14	OWC - 26
OWC - 15	OWC - 27
OWC - 16	
OWC - 17	
OWC - 18	
OWC - 19	
OWC - 20	

- 1) All wells will be sampled as part of the ongoing quarterly monitoring program.
- 2) Wells OWC - 24, OWC - 25, OWC - 26 and OWC - 27 will be sampled again two weeks after the initial quarterly sampling to provide verification of the original data.

SUBSURFACE SOILS

	<u>Suspected Maneb Area</u>	<u>Arsenic Offloading Area</u>	<u>Other Areas</u>
Estimated number of soil borings:	10	6	40
Estimated number of samples per boring:	4	3	1
Total number of samples:	40	18	40

TABLE 2
PARAMETERS FOR GROUND WATER SAMPLE ANALYSES

<u>Volatile Organics</u>	<u>Pesticides (Herbicides)</u>	<u>Pesticides (Insecticides)</u>	<u>Metals</u>	<u>Field Measurements</u>
Xylenes	2,4-D 2,4,5-T	Aldrin Dieldrin Lindane 4,4-DDT 4,4-DDE 4,4-DDD Chlordane Toxaphene Heptachlor Endrin	Arsenic	pH Temperature Specific conductivity

TABLE 3
PARAMETERS FOR SOIL SAMPLE ANALYSES

<u>Volatile Organics</u>	<u>Pesticides (Herbicides)</u>	<u>Pesticides (Insecticides)</u>	<u>Pesticides (Fungicides)</u>	<u>Metals</u>
Xylene	2,4-D 2,4,5-T	Aldrin Dieldrin Lindane 4,4-DDT 4,4-DDE 4,4-DDD Chlordane Toxaphene Heptachlor Endrin	Maneb Ethylene Thiourea	Arsenic

TABLE 4

ESTIMATED NUMBER OF SAMPLES TO BE ANALYZED BY WILSON LABORATORIES

<u>Matrix</u>	<u>Number of Samples</u>	<u>Parameters</u>	<u>Number of Duplicates</u>	<u>Number of Blanks</u>
Subsurface Soils	98 (estimated)	Table 3	10 (estimated)	-
Quarterly Ground Water *	13	Table 2	1	1
Ground Water **	4	Table 2	1	1

* Per quarterly sampling event

** Wells OWC-24, OWC-25, OWC-26, and OWC-27 will be sampled initially as part of the scheduled quarterly sampling. These new wells will be re-sampled two weeks after the initial sampling to provide verification of the data.

TABLE 5
CALIBRATION AND FIELD CHECK FREQUENCY SCHEDULES

<u>Field Instrumentation</u>	<u>Regular Calibration and Maintenance</u>	<u>Field Calibration Before Each Use</u>
Salinity-Conductivity- Temperature (SCT) Meter	Quarterly	Yes ¹
pH Meter	Prior to Use	Yes ²
HNu	Quarterly	Yes ³

¹ Instrument is calibrated immediately prior to each sampling event. Zero check and redline check immediately prior to each use in the field.

² Instrument is calibrated immediately prior to each use in the field.

³ Instrument calibrated daily.

TABLE 6

PARAMETER TABLE - GROUND WATER MATRIX

<u>Parameter</u>	<u>Analytical Reference Method</u>	<u>Sample Preservation</u>	<u>Holding Time</u>
Volatile Organics ¹	EPA Method 624	Cool to 4°C	14 days (Aromatics 7 days)
Pesticides ²	EPA Method 608	Cool to 4°C pH 5-9	7 days for extraction, 40 days after for analysis
Herbicides ³	Standard Methods ⁵ Method 509B	Cool to 4°C pH 5-9	7 days for extraction, 40 days after for analysis
Metals ⁴	EPA Method 206.2 ⁶	Cool to 4°C HNO ₃ to pH 2	6 Months

- NOTES:
- 1) Volatile organic analyses for: Total Xylenes
 - 2) Pesticide analyses for: Aldrin, Dieldrin, Lindane 4,4-DDD, 4,4-DDE, 4,4-DDT, Chlordane, Toxaphene, Heptachlor, Endrin, Methoxychlor.
 - 3) Herbicide analyses for: 2,4-D and 2,4,5-T.
 - 4) Metals analyses for: Arsenic
 - 5) "Standard Methods for the Examination of Water and Wastewater," 16th Edition, 1985.
 - 6) EPA Methods for water analysis are those described in "Methods for Chemical Analysis of Water and Wastes" EPA - 600/4-79-020 U.S. Environmental Protection Agency, March 1979.

TABLE 7

PARAMETER TABLE - SOIL MATRIX

<u>Parameter</u>	<u>Analytical Reference Method</u>	<u>Sample Preservation</u>	<u>Holding Time</u>
Volatile Organics ¹	EPA Method 8240 ⁵	Cool to 4°C	14 days (Aromatics 7 days)
Pesticides ²	EPA Method 8080 ⁵	Cool to 4°C	7 days for extraction; 40 days thereafter for analysis
Herbicides ³	EPA Method 8150 ⁵	Cool to 4°C	7 days for extraction; 40 days thereafter for analysis
Maneb	EPA Method 630 ⁶ (modified for soils)	Cool to 4°C	7 days for extraction; 40 days thereafter for analysis
Ethylene Thiourea	EPA Method 8140	Cool to 4°C	7 days for extraction; 40 days thereafter for analysis
Metals ⁴	EPA Method 7060 ⁵	Cool to 4°C	6 Months

- NOTES:
- 1) Volatile Organic Analysis for: Total Xylenes
 - 2) Pesticide Analyses for: Aldrin, Dieldrin, Lindane, 4,4-DDD, 4,4-DDE, 4,4-DDT, Chlordane, Toxaphene, Heptachlor, Endrin, Methoxychlor, Maneb
 - 3) Herbicide Analyses for: 2,4-D and 2,4,5-T
 - 4) Metals analyses for: Arsenic
 - 5) EPA Methods for soil analysis are those described in "Test Methods for Evaluating Soil Wastes" SW - 846, U.S. Environmental Protection Agency, Second Edition, 1982.
 - 6) There is currently no EPA approved method for the analysis of Maneb in soil. Discussion with EPA Region VII personnel indicated that EPA Method 630 could be modified appropriately for use with soils. The modification involves the addition of 50 grams of sample to a hydrolysis flask. The volume of the flask is then brought to 1500 ml utilizing reagent grade water and the pH maintained at less than 2.

TABLE 8

GROUND WATER SAMPLE COLLECTION SUMMARY

<u>Parameter</u>	<u>Total Number of Samples⁵</u>	<u>Sample Container</u>	<u>Container Size</u>	<u>Volume Analysis</u>	<u>Total Number of Containers⁶</u>
Volatile Organics ¹	21	VOA Vial	40-ml	(2) 40-ml	46
Pesticides ²	21	Amber Glass Jar Teflon Lined Cap	1/2 Gallon	1/2 Gallon	23
Herbicides ³	21	Amber Glass Jar Teflon Lined Cap	1/2 Gallon	1/2 Gallon	23
Metals ⁴	21	Polyethylene	1 Liter Cubitainer	1 Liter	23

- NOTES:
- 1) Volatile Organic Analysis for total xylenes
 - 2) Pesticides Analyses for: Aldrin, Dieldrin, Lindane, 4,4-DDD, 4,4-DDE, 4,4-DDT, Chlordane, Toxaphene, Heptachlor, Endrin, Methoxychlor, Maneb
 - 3) Herbicide Analyses for: 2,4-D and 2,4,5-T.
 - 4) Metals Analysis for: Arsenic
 - 5) Includes duplicate, blank, and spike samples and verification sampling at OWC-24, OWC-25, OWC-26, OWC-27
 - 6) Includes 10% surplus to account for breakage

TABLE 9

SOIL SAMPLE COLLECTION SUMMARY

<u>Parameter</u>	<u>Total Number of Samples⁵</u>	<u>Sample Container</u>	<u>Container Size</u>	<u>Volume Analysis</u>	<u>Total Number of Containers⁶</u>
Volatile Organics ¹	108	VOA vial	40-ml	(2) 40-1	240
Pesticides ²	108	Amber Glass Jar Teflon lined Cap	8 oz.	8 oz.	118
Herbicides ³	108	Amber Glass Jar Teflon lined Cap	8 oz.	8 oz.	118
Maneb/Ethylene Thiourea	90	Amber Glass Jar Teflon lined Cap	8 oz.	8 oz.	118
Metals ⁴	108	Amber Glass Jar Teflon lined Cap	8 oz.	8 oz.	118

- NOTES:
- 1) Volatile Organic Analysis for total xylenes
 - 2) Pesticides Analyses for: Aldrin, Dieldrin, Lindane, 4,4-DDD, 4,4-DDE, 4,4-DDT, Chlordane, Toxaphene, Heptachlor, Endrin, Methoxychlor, Maneb
 - 3) Herbicide Analyses for: 2,4-D and 2,4,5-T
 - 4) Metals Analysis for: Arsenic
 - 5) Includes duplicate, blank, and spike samples
 - 6) Includes 10% surplus to account for breakage

TABLE 10

DATA QUALITY OBJECTIVES - GROUND WATER MATRIX

<u>Parameter</u>	<u>Detection Limit</u>	<u>Completeness</u>		<u>Std. Dev.</u>	<u>Precision Accuracy</u>
		<u>Analytical</u>	<u>Field</u>		
Volatile Organics ¹	1 ppb	90%	80%	± 20%	6
Pesticides ^{2,5}	0.1 ppb	90%	80%	± 20%	6
Herbicides ³	1 ppb	90%	80%	± 20%	6
Metals ⁴	10 ppb	90%	80%	± 20%	6

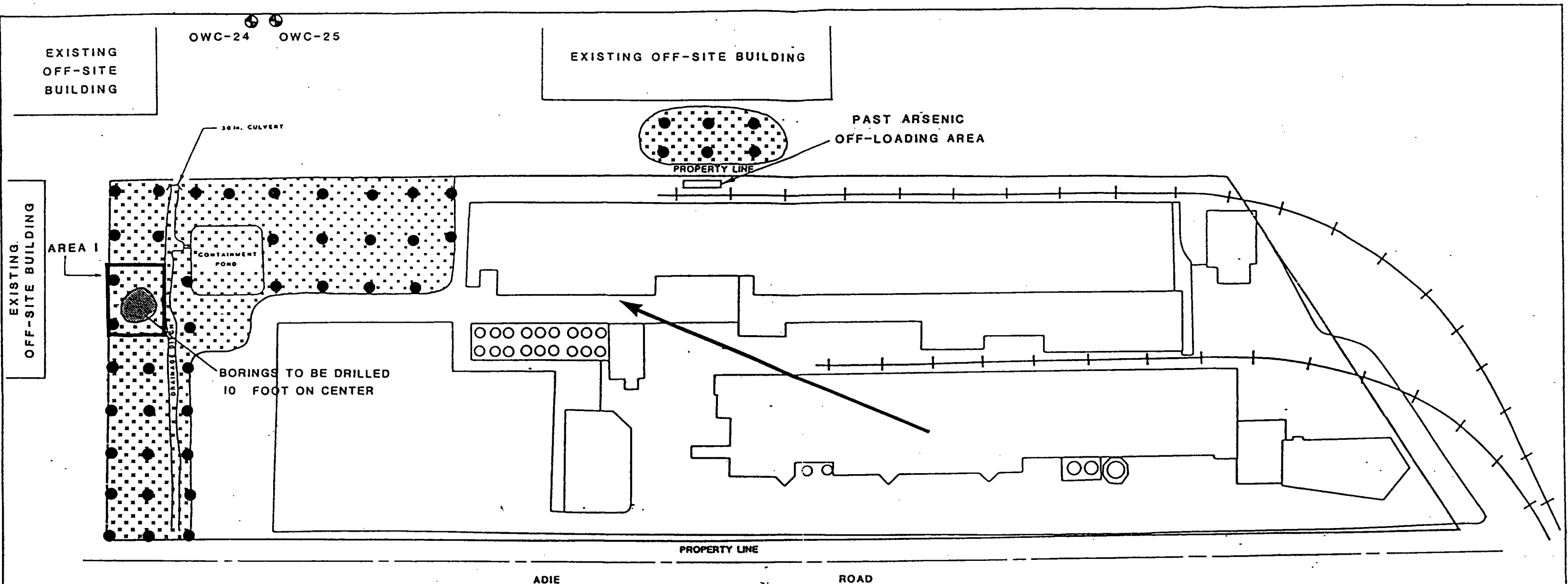
- NOTES:
- 1) Volatile Organic Analysis for total xylenes
 - 2) Pesticides Analyses for: Aldrin, Dieldrin, Lindane, 4,4-DDD, 4,4-DDE, 4,4-DDT, Chlordane, Toxaphene, Heptachlor, Endrin, Methoxychlor
 - 3) Herbicide Analyses for: 2,4-D and 2,4,5-T
 - 4) Metals Analysis for: Arsenic
 - 5) Toxaphene detection limit 5 ppb.
 - 6) Accuracy will be the responsibility of the analytical laboratory

TABLE 11

DATA QUALITY OBJECTIVES - SOIL MATRIX

<u>Parameter</u>	<u>Detection Limit</u>	<u>Completeness</u>			<u>Precision Accuracy</u>
		<u>Analytical</u>	<u>Field</u>	<u>Std. Dev.</u>	
Volatile Organics ¹	5 ug/kg	90%	80%	± 20%	6
Pesticides ^{2,5}	5 ug/kg	90%	80%	± 20%	6
Herbicides ³	50 ug/kg	90%	80%	± 20%	6
Maneb	NA ⁷	90%	80%	± 20%	6
Ethylene Thiourea	1 mg/kg	90%	80%	± 20%	6
Metals ⁴	1 mg/kg	90%	80%	± 20%	6


- NOTES:
- 1) Volatile Organic Analysis for: total xylenes
 - 2) Pesticides Analyses for: Aldrin, Dieldrin, Lindane, 4,4-DDD, 4,4-DDE, 4,4-DDT, Chlordane, Toxaphene, Heptachlor, Endrin, Methoxychlor
 - 3) Herbicides Analyses for: 2,4-D and 2,4,5-T
 - 4) Metals Analysis for: Arsenic
 - 5) Toxaphene detection limit 250 ug/kg.
 - 6) Accuracy will be the responsibility of the analytical laboratory
 - 7) The detection limit for Maneb will be established by the analytical laboratory.



LEGEND

- OWC-24
- PROPOSED MONITORING WELL
- PROPOSED SOIL SAMPLING AREAS
- SUSPECTED MANEB BURIAL AREA
- APPROXIMATE FLOW DIRECTION OF SHALLOW GROUND WATER
- PROPOSED SOIL BORING/ SOIL SAMPLE LOCATIONS

0 50 100
SCALE, FT.

ORTHO CHEVRON PLANT MARYLAND HEIGHTS, MISSOURI			
 Woodward-Clyde Consultants <small>ENGINEERS, GEOLOGISTS, AND ENVIRONMENTAL SCIENTISTS</small>			
PROPOSED FIELD INVESTIGATIONS			
DRN. BY 97	DATE 6-22-86	PROJECT NO. 13C114-17	FIG. NO. 1
CHK'D BY JBM	DATE 6-23-86		

CHAIN OF CUSTODY RECORD
WOODWARD-CLYDE CONSULTANTS
5055 Antioch Road
Overland Park, Kansas 66203
(913)432-4242

Observation Well I.D. No.: _____				Project No.: _____		
Samplers (signatures): _____				Project Title: _____		
Sample I.D. No.	Date	Time	Container Description	No. of Containers	Required Analyses	Comments
Relinquished by		Date	Time	Received by		Date Time
Relinquished by		Date	Time	Received for Laboratory by		Date Time
Method of Shipment:				Airbill (or shipping invoice) Number):		

* Sample analysis to be performed according to specifications detailed in the Federal Register, Vol. 45, No. 98, Monday, May 19, 1980: Subpart F (Sec. 265.92).

ATTACHMENT A

(To the QA/QC Plan)

WILSON LABORATORIES QUALITY ASSURANCE PLAN

QUALITY ASSURANCE PLAN

WILSON LABORATORIES
P.O. BOX 1884
SALINA, KANSAS 67402-1884
(913) 825-7186

Approved By David H. LeMaster for SEA 9/6/85
Stephen E. Ascher Date
Laboratory Director

Lynn R. Newcomer
Chief Chemist Date

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SECTION I PLAN DESCRIPTION

PURPOSE

The purposes of this Quality Assurance (Q.A.) Plan are: (a) to define the nature and extent of Quality Assurance for all chemical analyses performed by the Laboratory; (b) to set forth the requirements for preparation of Quality Assurance procedures; and (c) to provide a description of the methods to be used in carrying out the Quality Assurance Program.

SCOPE

This Quality Assurance Plan is intended to encompass the entire measurement system from initial sampling to final reporting of results and any other project requirements.

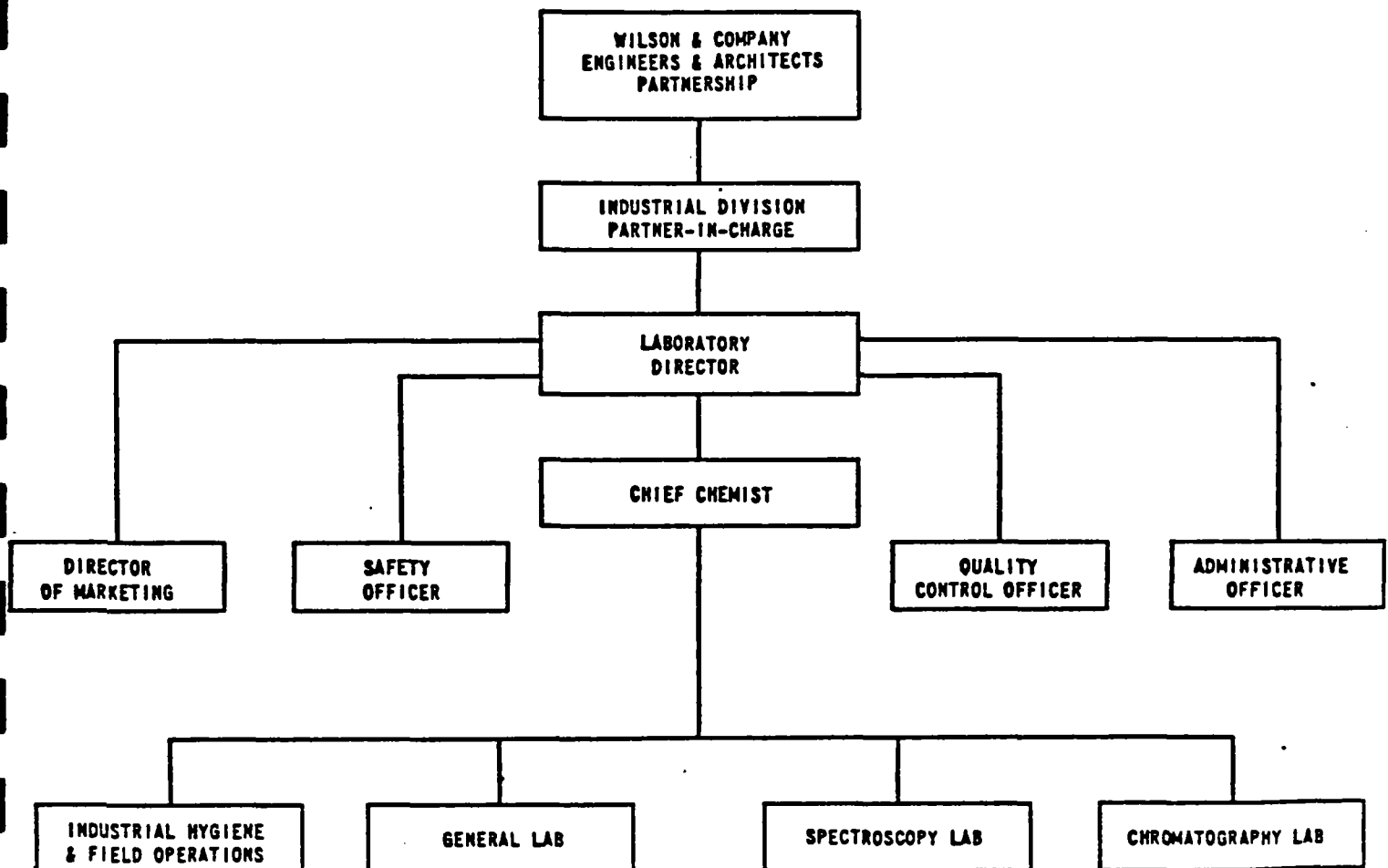
OBJECTIVES

The overall objective of this Q.A. Plan is to assure that Wilson Laboratories produces valid data for all analytical procedures utilized by the Laboratory. This is accomplished by: (a) verifying that work procedures and practices are adequate and acceptable to the client and regulatory agencies; (b) coordinating an interlaboratory Quality Control program to assess the continuing capability and relative performance of Wilson Laboratories with other laboratories; and (c) participation in an intralaboratory Quality Control program which assists Wilson Laboratories in maintaining the accuracy and precision of data produced by its personnel.

SECTION II
ORGANIZATION STRUCTURE

ORGANIZATION STRUCTURE

The structure of Wilson Laboratories within the Company organization is shown below:



PROJECT MANAGER

A Wilson Laboratories staff member is designated "Project Manager" for each client's program. The Project Manager receives requirements and specifications for the program and is responsible for:

- a. Scheduling the work in consultation with Department Heads;
- b. Monitoring work progress and responding to client inquiries;
- c. Verifying that chemical analysis activities are documented and coordinated with the client's program;
- d. Verifying that all chemistry procedures and practices are correct and adequate for the intended usage and required accuracy and reliability of results;
- e. Assuring that the procedures and practices conform to the client's specifications with respect to methods and frequency of sampling and analysis;
- f. Verifying that procedures and practices are appropriate for and consistent with the client's specifications and other regulatory criteria.

CLIENTS

Wilson Laboratories' clients are an integral part of the Laboratory Quality Assurance Program. Policies and procedures governing work performed for a client are subject to review and approval by the client and by the Laboratory Quality Assurance staff. Wilson Laboratories is responsible to its clients for the implementation of policies and procedures stated or referenced in this document.

LABORATORY DIRECTOR

The Laboratory Director is responsible for the overall operation of the laboratory. His duties include:

- a. Overall direction and general administration.
- b. Overall direction of Quality Assurance Program.
- c. Recruitment, hiring, assignment and evaluation of personnel.
- d. Facilities planning, evaluation and purchase of analytical instruments.
- e. Review of all work procedures and practices.

- f. Training and professional development.
- g. Coordination of marketing and client development.
- h. Review of proposals, bids, pricing and quotations.

QUALITY CONTROL OFFICER

The Quality Control Officer reports directly to and receives Q.A. direction directly from the Laboratory Director. The Q.C. Officer has sufficient authority and organizational freedom to identify quality problems; to initiate, recommend or provide solutions; and to verify implementation of solutions. The Q.C. Officer's duties and responsibilities are as follows:

- a. Development of Quality Assurance procedures, instructions and plans;
- b. Maintaining surveillance over all routine and non-routine aspects of the Quality Assurance plan;
- c. Evaluating Q.C. data reports;
- d. Performing inspections, writing reports and providing follow-up action;
- e. Making recommendations for resolution of problems, further evaluation by management, or stop-work orders;
- f. Coordinating Q.A. activities (e.g., propose changes of policy or procedures) among Directors, Managers and Supervisors;
- g. Managing the interlaboratory comparison program to assure full and prompt participation, evaluation of results and derivation of all benefits relating therefrom.
- h. Forwarding audit reports to the responsible Directors, Managers and Supervisors for corrective actions;
- i. Maintaining records of proficiency analyses results and of the certification certificates.

DEPARTMENT SUPERVISORS

The Department Supervisors assure that Q.A. policy and procedures are carried out in their areas of responsibility. They are responsible for:

- a. Assisting in development of Quality Assurance procedures, instructions and plans for their department;
- b. Making all individuals in their department aware of relevant Quality Assurance practices;

- c. Maintaining surveillance over all routine and non-routine aspects of the Quality Assurance plan as it pertains to their department;
- d. Informing the Quality Control Coordinator of any situation requiring immediate attention as it relates to Quality Assurance;
- e. Making recommendations to the Quality Control Coordinator in any pertinent area of Quality Assurance;
- f. Assuring that qualified personnel are provided with continued training, as necessary, for proper performance of the analytical work;
- g. Verifying that records are completed and maintained for each analysis conducted in their department;
- h. Maintaining and calibrating equipment to the extent and at the frequency necessary for accurate results;
- i. Assuring that all other areas of concern having a direct effect on their department contain adequate Quality Control features and that such Quality Controls are practiced as part of a normal routine.

CHIEF CHEMIST

The Chief Chemist is responsible for:

- a. Development and review of Quality Assurance procedures.
- b. Making recommendations for technical decisions.
- c. Evaluating and reviewing test procedures.
- d. Ensuring that approved analytical procedures are used when possible or that state-of-the-art methods are used when approved methods are not available.
- e. Issuing stop-work orders for work which is not in compliance with requirements.
- f. Directing laboratory certification programs.
- g. Reviewing and signing all laboratory reports.
- h. Project Manager assignments.

ADMINISTRATIVE OFFICER

The Administrative Officer is responsible for:

- a. General office operations, correspondence and filing.
- b. Computer operations.
- c. Production scheduling and expediting.
- d. Shipping and receiving.
- e. Chain of custody and sample security.
- f. Sample management.
- g. Report and document generation.
- h. Purchasing and inventory control.
- i. Client billing and accounts receivable collection.

TECHNICIANS

Technicians are responsible for:

- a. Performing sample preparations and analyses.
- b. Maintaining a clean working environment.
- c. Performance of Q.A. analyses in accordance with laboratory policy and recording of all quality control data on the Shewhart charts.
- d. Informing their immediate supervisor of any results out of specifications for a specific analysis.
- e. Making recommendations to their immediate supervisor regarding Q.A. performance.

SECTION III QUALIFICATIONS OF PERSONNEL

GENERAL

All persons hired or assigned to the positions described in this document receive OJT by working with experienced personnel. Their work is closely supervised and evaluated. The principal criterion for employment or assignment is demonstrated professional proficiency at Wilson Laboratories or elsewhere.

LABORATORY STAFF MEMBERS

Individual laboratory staff members are introduced by the appended resumes. We have developed an organization of technical specialists in all major disciplines of the environmental sciences. Each person is thoroughly trained and experienced in his respective field and qualified to function with other staff members to form an integrated team.

Required educational and experience qualifications of Laboratory personnel are described below:

Laboratory Director: Minimum B.S. Degree in Chemistry from an ACS accredited school, with a minimum of 15 years of experience.

Chief Chemist: Minimum M.S. Degree in Chemistry from an ACS accredited school, with a minimum of 10 years of experience.

Quality Assurance Officer: Minimum B.S. Degree in Chemistry from an ACS accredited school, with a minimum of 8 years of experience.

Section Chiefs Spectroscopy, Chromatography: Minimum B.S. Degree in Chemistry from an ACS accredited school with a minimum of 5 years of experience. Directs, plans and performs analytical effort within the section.

Chemists: Minimum B.S. Degree in Chemistry from an ACS accredited school with a minimum of 2 years of experience.

Technicians: B.S. or B.A. Degree in Scientific Discipline or equivalent laboratory experience.

PROFESSIONAL AFFILIATIONS

Maintaining Quality Assurance requires that staff members be aware of the changing requirements and advancements in their fields. This requirement is partially met by staff members belonging to the following organizations:

- American Chemical Society
- American Industrial Hygiene Association
- American Water Works Association
- Water Pollution Control Federation
- American Academy of Environmental Engineers
- National Society for Professional Engineers
- American Institute of Chemical Engineers
- American Society of Civil Engineers
- American Society for Testing Materials
- National Association of Corrosion Engineers
- Air Pollution Control Association
- American Public Works Association
- Association of Official Analytical Chemists

SECTION IV RECORDS

GENERAL

Records of all steps in the processing of a client's order, from the specifications of the order to the delivery of the results are maintained. These records detail the sample identification, the date of performance, the analytical procedures followed, the results obtained, the measure of precision and accuracy achieved and the identities of those who performed the analyses, and reviewed and approved the results.

SPECIFIC RECORDS MAINTAINED

Records providing information in the following areas are maintained either in laboratory notebooks, files or computer storage:

- a. Statements of Laboratory Policy
- b. Analytical Procedures
- c. Client's orders, proposals and contracts
- d. Sample collection
- e. Sample receipts
- f. Sample description and laboratory identification number
- g. Sample preparation
- h. Analytical results
 - i. Reviews and approvals
 - j. Reports submitted to clients
- k. Precision checks of instruments
- l. Results of analyses of quality control samples
- m. Results of interlaboratory analyses
- n. Verifications of computer and personnel computations
- o. Quality assurance reports
- p. Preparation of standards and carrier solutions

PERIOD OF RECORD RETENTION

Statements of policies and procedures are signed and dated by the Laboratory Director. Superseded procedures are retained permanently on file. Records of all chemical analyses and reports are retained permanently on microfilm and on tape.

SECTION V
CHAIN-OF-CUSTODY PROCEDURES

Sample chain-of-custody is maintained when required by the client or the Regulatory agency. All samples that are collected by Wilson Laboratories personnel are maintained under chain-of-custody control. This procedure insures that the samples are collected, transferred, stored, analyzed and disposed of only by authorized personnel.

Immediately upon receipt, samples are logged into the computer which tabulates test assignments and analytical data. This program assures that all tests are performed in a timely manner, while assuring quality and completeness. After being logged in, the samples are placed in a designated, clean, dry room with refrigeration. Once the sample analyses are completed, the unused portion of the sample, together with identifying labels and other documentation are returned to storage.

SECTION VI
COMPUTERIZED INFORMATION MANAGEMENT SYSTEM

The Laboratory utilizes computerized sample tracking and scheduling procedures, beginning with the log-in procedure upon receipt of sample and ending with a computer generated final report.

All client and sample information are entered into the computer at log-in. Included are date received, date and time sampled, sample collector and any field data, such as pH and temperature. Note is made of physical condition and appearance of each sample. Daily schedules are issued for control of the work load and for adherence to required holding and turn-around times for the various analyses. Sample storage locations are also tracked by the computer. All new data are kept in bound notebooks and hard copies of all completed reports are retained. All data are permanently retained on tape also.

Wilson Laboratories utilizes a Perkin-Elmer LIMS system for computerized information management. All program development and software development have been developed by in-house personnel and the computerized system has been operational since September 1983. Copies of typical computer information detail are appended in this document.

SECTION VII QUALITY CONTROL IN SAMPLING

GENERAL

Sample collection is an assigned laboratory function. The Quality Control Officer interfaces with sample collectors to assure understanding of selection, collection and storage and transportation practices. For data to be meaningful, a sample must be representative of existing conditions and properly handled to avoid contamination or deterioration before it reaches the laboratory.

For routine activities, the location of each sampling site is selected and the number, type and size of containers is specified before a sample collector goes to the field. The sample source, amount to be collected, analyses and instructions are indicated on the sample container. Other pertinent information is written in waterproof, ballpoint ink on a sample tag: sample number, date and time taken, source of sample, preservative, analyses to be performed and name of sample collector.

Environmental Samples

Composite or grab sampling requirements are predetermined. Composite samples are preferred when "average concentrations" are the objective (e.g., wastewater treatment plant efficiency determinations); grab samples are preferred when the objective is documenting the extent, frequency and duration of variations in the sample. In some cases, both composite and grab sampling data are required.

Industrial Hygiene Samples

NIOSH or other recognized procedures are used for sample collection, preservation and storage.

Sampling equipment and sampling media utilized are approved for industrial hygiene samples.

Sampling times and rates are as required by the methodology protocol. Pumps are calibrated in the laboratory immediately prior to use.

When sampling is performed by others, using Wilson equipment, specific instructions are supplied for the use of the equipment. The pumps are precalibrated before use. If long-term use is contemplated, equipment is either returned to the laboratory for recalibration or calibration equipment is supplied to the client for field use.

All sample containers are sealed and tagged before they are shipped to the laboratory. Shipping procedures vary with the analyses to be performed. Refrigeration, as with ice or freeze packs, is used for samples for biochemical oxygen demand (BOD), phenol, nitrogen, cyanide, oil or chlorinated hydrocarbon analyses. Appropriate labels as "Do Not Freeze," or "Fragile," are used when applicable.

A field notebook (logbook) is completed at the site by the sample collector. Information equivalent to that on the tag is included, together with results of measurements taken in the field (e.g., temperature, dissolved oxygen [DO], pH, conductivity, flow) and pertinent observations at the time of sampling. Chain-of-custody forms are completed in the field at time of sample collection and accompany the samples to the Laboratory.

CONTINUOUS SAMPLING

- a. The accuracy of devices used for continuous sampling of liquids and gases involving the measurement of sample flow rates and/or sample volumes is determined on regularly scheduled basis.
- b. Adjustment of these devices is made as needed to bring the performance of the devices within specified limits.
- c. The frequency of sampling device calibrations is specified and is based on the required accuracy, purpose, degree of usage, stability characteristics and other conditions affecting the measurement.
- d. Tests are conducted to verify that continuous sampling is representative of the material volumes sampled.

GRAB SAMPLES

- a. Tests are conducted to verify that grab samples are representative of the material sampled.
- b. Replicate samples are taken periodically to demonstrate the reproducibility of sampling.

MAINTENANCE OF SAMPLE INTEGRITY

Procedures for sampling, packaging, shipping and storage of samples provide for the maintenance of the integrity of the samples.

A summary of sampling and handling requirements for chemical and physical analyses followed by Wilson Laboratories, taken from Standard Methods for the Examination of Water and Wastewater follows. Time-sensitive samples are analyzed within the period specified for holding.

**SUMMARY OF SPECIAL SAMPLING OR
SAMPLE HANDLING REQUIREMENTS¹**

<u>Determination</u>	<u>Container²</u>	<u>Minimum Sample Size, ml</u>	<u>Storage and/or Preservation</u>
Acidity	P, G(B)	100	24 hr; refrigerate
Alkalinity	P, G(B)	200	24 hr; refrigerate
BOD	P, G	1,000	6 hr; refrigerate
Boron	P	100	--
Carbon, organic, total	G(brown)	100	Analyze as soon as possible; refrigerate or add HCl to pH 52
Carbon dioxide	P, G	100	Analyze immediately
COD	P, G	100	Analyze as soon as possible; add H ₂ SO ₄ to pH 52
Chlorine dioxide	P, G	500	Analyze immediately
Chlorine, residual	P, G	500	Analyze immediately
Chlorophyll	P, G	500	30 days in dark; freeze
Color	G	500	--
Cyanide	P, G	500	24 hr., add NaOH to pH 12; refrigerate
Fluoride	P	300	--
Grease and Oil	G, wide-mouth calibrated	1,000	Add HCl to pH 52
Iodine	P, G	500	Analyze immediately
Metals	P, G	-	For dissolved metals separate by filtration immediately; add 5 ml conc HNO ₃ /l
Nitrogen Ammonia	P, G	500	Analyze as soon as possible; add 0.8 ml conc H ₂ SO ₄ /l; refrigerate
Nitrate	P, G	100	Analyze as soon as possible; add 0.8 ml conc H ₂ SO ₄ /l; refrigerate
Nitrite	P, G	100	Analyze as soon as possible; add 40 mg HgCl ₂ /l and refrigerate or freeze at -20° C
Organic	P, G	500	Analyze as soon as possible; refrigerate or add 0.8 ml conc H ₂ SO ₄ /l
Odor	G	500	Analyze as soon as possible; refrigerate
Oxygen, dissolved ³	G, BOD bottle	300	Analyze immediately
Ozone	G	1,000	Analyze immediately
Pesticides (organic)	G (S)	-	--
pH	P, G (B)	-	--
Phenol	G	500	24 hr.; add H ₃ PO ₄ to pH 54.0 and 1 g CuSO ₄ ·5H ₂ O/l; refrigerate
Phosphate	G (A)	100	For dissolved phosphates separate by filtration immediately; freeze at 5-10° C and/or add 40 mg HgCl ₂ /l
Residue	P, G (B)	-	--
Salinity	G, wax seal	240	Analyze immediately or use wax seal
Silica	P	-	--
Sludge digester gas	G, gas bottle	-	--
Sulfate	P, G	-	Refrigerate

<u>Determination</u>	<u>Container</u> ²	<u>Minimum Sample Size, ml</u>	<u>Storage and/or Preservation</u>
Sulfide	P, G	100	Add 4 drops 2N zinc acetate/100 ml
Sulfite	P, G	-	Analyze immediately
Taste	G	500	Analyze as soon as possible; refrigerate
Temperature	-	-	Analyze immediately
Turbidity	P, G	-	Analyze same day; store in dark for up to 24 hrs.

Source: Standard Methods.⁴

¹For determinations not listed, no special requirements have been set; use glass or plastic containers, preferably refrigerate during storage and analyze as soon as possible.

²P = plastic (polyethylene or equivalent); G = glass; G(A) or P(A) = rinsed with 1+1 HNO₃; G(B) = glass, borosilicate; G(S) = glass, rinsed with organic solvents.

³If Winkler procedure is followed, mix in the field by adding flocculating reagents, (MnSO₄ and alkaline KI) and dissolving precipitate with H₂SO₄. Keep bottles protected from light. Fixed samples should be refrigerated for transport and analyzed as soon as possible. Refer to Standard Methods⁴ for preserving and handling special samples.

⁴Standard Methods for the Examination of Water and Wastewater, 14th Edition, APHA-AWWA-WPCF, 1975.

SECTION VIII FACILITIES

GENERAL

Facilities are maintained to provide optimum conditions for laboratory analysis. Support facilities include:

DESIGNATED USAGE AREAS

- a. Water Chemistry Laboratory
- b. Spectroscopy Laboratory
- c. Chromatography Laboratory
- d. Gas Chromatograph/Mass Spectrometer Laboratory
- e. Research Laboratory
- f. Biological Laboratory
- g. Soils Laboratory
- h. Shipping and Receiving
- i. Technical Library
- j. Offices
- k. Utility and Gas Storage Areas
- l. Refrigerators
- m. Sample Preparation Laboratory

WORKING SPACE

- a. 16,000 square feet of floor space
- b. 20 linear feet of bench space per analyst
- c. Bench space designed appropriate for tests performed
- d. Optimized lighting
- e. Heated, air conditioned and humidity controlled

WATER SUPPLIES AND UTILITIES

- a. Hot and cold running water
- b. High-capacity sinks and drains, capable of accepting acid waste
- c. Distilled/deionized water
- d. Ultrahigh-purity water for trace-level analyses
- e. 110/220-volt circuits for instrumentation
- f. Centralized vacuum source (pump)
- g. Oil-free centralized air compressor

EXHAUST HOODS

- a. High-capacity withdrawal to vent organic solvents and acid fumes
- b. Laminar flow hood for carcinogens and biologicals
- c. Total of eleven (11) strategically located hoods

AUXILIARY SPACE

- a. Closets/cabinets to keep working areas free of accumulated sample containers, reagents, etc.
- b. Desks for analysts to calculate results, write reports, etc.

CLEANLINESS

- a. Frequent cleaning of surfaces to reduce dust contamination
- b. High-capacity washing machine; no phosphate detergents
- c. Restricted area for acid washing of glassware
- d. Filtered circulating air to reduce contamination
- e. Restricted-traffic clean areas for trace analyses

SAFETY FEATURES

- a. Compliance with state and Federal Occupational Safety and Health Administration regulations
- b. Fire extinguishers, safety showers, eyewash stations
- c. Mandatory eye protection requirements
- d. First aid equipment
- e. Protective garments
- f. Chemical dispensing devices; restrictions on mouth pipetting

TECHNICAL REFERENCE LIBRARY

- a. Major journals and reference texts
- b. Interlibrary loan agreements
- c. Special topic computer search service, as needed
- d. Appropriate AIHA, AOAC, EPA, ASTM, FDA and other manuals as required

COMPUTERIZED DATA MANAGEMENT SYSTEM

Principal functions:

- a. Sample log-in and computer labeling
- b. Sample storage location
- c. Work Schedules
- d. Computerized Reports

SECTION IX
GENERAL WORK INSTRUCTIONS AND PROCEDURES

General work instructions and procedures used in all chemical analyses are written or referenced in an on-site reference and made available to all analysts. The department supervisor is responsible for assuring that each analyst and technician is familiar with all pertinent operating procedures. Applicable instructions and procedures include:

- a. General rules
- b. Records
- c. Cleaning
 - (1) Glass and plastics laboratory ware
 - (2) Absorption cells
 - (3) Stopcock grease removal
- d. Weighing and balance care
- e. Standard samples
- f. Reagents storage and handling
- g. Operations
 - (1) General
 - (2) Gravimetric
 - (3) Volumetric
- h. Calibration
 - (1) Electrodes
 - (2) pH meter
 - (3) Other
- i. Quality control
- j. Laboratory safety

SECTION X LABORATORY EQUIPMENT

GENERAL

All equipment is maintained in proper working order with a written log for maintenance, repair and calibration of each appropriate piece of equipment. All major instrumentation is under service contract with the manufacturer and provided with required maintenance at regular intervals. Where applicable, reference materials certified by the National Bureau of Standards, including thermometers, are used for calibration purposes. Wilson Laboratories maintains the operating, service and calibration manuals provided by the manufacturer for all laboratory equipment. Maintenance files and service records are maintained for all instruments. Wilson Laboratories meets or exceeds certification requirements regarding mandatory calibration and/or maintenance of equipment.

MAJOR INSTRUMENTATION

A list of Wilson Laboratories' major instrumentation follows:

Gas Chromatography/Mass Spectrometry

Finnigan OWA-30 Automated GC/MS System equipped with Tekmar LSC-2 Automated Liquid Sample Concentrator. System also equipped with syringe autosampler for liquid samples. Nine track magnetic tape drive interfaced to system for archival storage. Capability for packed column and capillary chromatography.

Gas Chromatography

1. Tracor, Model 560 - Split/splitless capillary injection system
Model 700A Hall Detector for halogens, nitrogen and sulfur
Tracor, Model 702 Alkali Flame Ionization Detector for nitrogen and phosphorous
Flame Ionization Detector for general organics analysis
Autosampler
2. Perkin-Elmer Model 900
HNU Photoionization Detector for volatile hydrocarbons
Flame Ionization Detector
Flame Photometric Detector for phosphorus and sulfur
Thermal Conductivity Detector
3. Hewlett-Packard, Model 5710A - Split/splitless capillary injection system
Electron Capture (Ni 63) Detector
Western Scientific Modified Coulson Detector for halides and nitrogen
Autosampler

4. Data Processors for Gas Chromatographs
Perkin-Elmer Sigma 10 with Basic
Hewlett-Packard Model 3380A
Spectro Physics 4100 with Basic
5. Tekmar, Model LSC-1
Purge and Trap Apparatus for analysis of volatile organics
6. Varian, Model 3700
Flame Ionization Detector (FID)
Alkali FID
Electron Capture Detector

Liquid Chromatography

Perkin-Elmer Series 3B liquid chromatograph with variable wave length UV detector, with auto control, auto sampler and Sigma 10 Data Processor. This versatile instrument allows Wilson Laboratories to perform a multiplicity of analyses. Gel permeation chromatography and molecular weight distributions are two special analyses this system performs. Additional detectors: Weskan ED-110 Electrochemical Detector, Refractive Index detector and Weskan 2130 Conductivity Detector.

Infrared Spectrophotometry

Perkin-Elmer Model 283 research grade unit coupled with the ASTM Sirch computer program to aid in identification of unknown compounds. This program contains spectra of over 200,000 compounds and is run on the IBM-360.

Atomic Absorption for Metals Analysis

1. Perkin-Elmer Model 5000 with Model HGA-500 furnace with temperature programming and an AS-50 autosampler.
2. Perkin-Elmer Model 503 with HGA-2100 furnace temperature programmer and autosampler. Arsenic and selenium are run by hydride generation.
3. Mercury is analyzed using a Coleman MAS-50 flameless AA analyzer.

UV Visible Spectrophotometry

Varian Model 635 double beam recording spectrophotometer with cells from 1 cm to 10 cm. Spectra are recorded on a Hewlett-Packard Model 235 X-Y recorder.

Technicon Autoanalyzer II

The system has both colormetric and ISE (ion specific electrode) detection systems. Modules are available for all analyses which are EPA approved for automated procedures.

Sulfate
Nitrate/Nitrite
Phosphate, ortho
Chloride
Phenol

pH
Conductivity
Fluoride
Alkalinity

4. Data Processors for Gas Chromatographs
Perkin-Elmer Sigma 10 with Basic
Hewlett-Packard Model 3380A
Spectro Physics 4100 with Basic
5. Tekmar, Model LSC-1
Purge and Trap Apparatus for analysis of volatile organics
6. Varian, Model 3700
Flame Ionization Detector (FID)
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Technicon Autoanalyzer II

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Sulfate
Nitrate/Nitrite
Phosphate, ortho
Chloride
Phenol

pH
Conductivity
Fluoride
Alkalinity

Thin-Layer Chromatography

Samples to be analyzed by thin-layer chromatography are prepared by the same procedures used for pesticide analysis. After K-D concentration, the thin-layer chromatograms are developed. The following equipment is utilized:

1. Thin-layer plates - Glass plates (200 x 200 mm) coated with 0.25 mm layer of Silica Gel G (gypsum binder).
2. Spotting Template
3. Developing Chamber
4. Sprayer - 20 ml capacity

The methods used are published in NPDES, Appendix A, Federal Register, 38 No. 75, Part II.

Total Organic Carbon Analysis

Beckman 915 unit with Beckman Model 865 Infrared Analyzer.

Total Organic Halogen Analysis

Dohrmann DX-20 Analyzer with an AD-2 adsorption module

Inductively Coupled Argon Plasma

Perkin-Elmer 6000 with a 7500 Data Station

SECTION XI CHEMICALS/REAGENTS

Chemicals no less pure than "analytical reagent grade" are used in the Laboratory. A higher quality grade chemical or reagent is used when required by a particular procedure. "Pesticide grade" organic solvents are used for the organic extractions, and acids suitable for mercury determinations are used for metal analyses. Reagent blanks, methods blanks and working reagents are made with distilled/deionized water having a specific conductance of less than 2.0 micromhos/cm at 25° C.

Wilson Laboratories has a centralized distilled/deionized water system which is protected from the atmosphere and its quality is checked daily and documented. Activated carbon cartridges are located in the chromatography laboratories, atomic absorption laboratory and the preparation laboratory and provides polishing treatment, resulting in distilled/deionized water having less conductivity than 1.0 micromhos/cm at 25° C. Compressed gases used are of a grade equal to or higher than that specified by the procedure.

Chemical standards are traceable to NBS Standards where traceability is possible. All standards used are certified standards or are ACS reagents quality materials.

SECTION XII METHODOLOGY

Analytical methods used by Wilson Laboratories are published in Standard Methods for the Examination of Water and Wastewater, EPA Methods of Chemical Analysis of Water and Wastes (600/4-79-020, March 1983), USEPA document "Test Methods for Evaluating Solid Waste" SW-846, NIOSH Manual of Analytical Methods, Methods of Analysis of AOAC, and Annual Book of ASTM Standards, Water of the American Society for Testing and Materials.

All analyses are performed by use of standard procedures. As a general methodology guide, Standard Methods, published jointly by the American Public Health Association (APHA), American Water Works Association (AWWA), and Water Pollution Control Federation (WPCF), is used for environmental samples. The review requirement associated with this text (i.e., at intervals no greater than five years) assures current, on-going evaluation of adequacy and appropriateness of the methods. By definition, a "standard" method in this text is one that has undergone a structural program of collaborative testing; a "tentative" method is one that has been used with a high level of confidence, but has not been collaboratively tested.

EPA published the Manual of Chemical Methods which contains valid, rapid test methods having sufficient precision, accuracy and specificity to measure specific parameters in the presence of common interferences, using the skills and equipment that are usually available in water and wastewater laboratories. Additional EPA methods are published periodically in the Federal Register and are reviewed and adopted by Wilson Laboratories.

Industrial hygiene procedures utilized are as published by the U.S. Department of Health, Education and Welfare, NIOSH Manual of Analytical Methods, 2nd Ed., Volumes 1 through 7 or other recognized analytical procedure.

ASTM methods are used when applicable. All reported analyses reference the specific procedure that was followed. If data are to be used to support National Pollutant Discharge Elimination System permit requirements, compliance with stream or effluent quality standards or enforcement actions, EPA-approved methods are used. These methods are published from time to time in the Federal Register. A list of the methods routinely used by Wilson Laboratories follows:

TABLE I. LIST OF APPROVED TEST PROCEDURES
UTILIZED BY WILSON LABORATORIES

<u>Parameter and Units</u>	<u>Method</u>
Acidity, as CaCO_3 , milligrams per liter.	Electrometric end point (pH of 8.3) or phenolphthalein end point.
Alkalinity, as CaCO_3 , milligrams per liter.	Electrometric titration (only to pH 4.5) manual or automated, or equivalent automated methods.
Ammonia (as N), milligrams per liter.	Electrode
BACTERIA	
Coliform (fecal), number per 100 ml.	MPN; membrane filter.
Coliform (fecal) in presence of chlorine, number per 100 ml	MPN; membrane filter.
Coliform (total) number per 100 ml	MPN; membrane filter.
Coliform (total) in presence of chlorine, number per 100 ml.	MPN; membrane filter with enrichment.
Fecal streptococci, number per 100 ml.	MPN; membrane filter; plate count.
Biochemical oxygen demand, 5-d (BOD_5), milligrams per liter.	Winkler (Azide modification) or electrode method.
Bromide, milligrams per liter.	Titrimetric, iodine-iodate.
Chemical oxygen demand (COD), milligrams per liter.	Dichromate reflux.
Chloride, milligrams per liter.	Mercuric nitrate; or automated colorimetric-ferricyanide.
Chlorinated organic compounds (except pesticides), milligrams per liter.	Gas chromatography.
Chlorine--total residual, milligrams per liter.	Iodometric titration amperometric or starch-iodine endpoint.

<u>Parameter and Units</u>	<u>Method</u>
Color, platinum cobalt units or dominant wave length, hue, luminance, purity.	Colorimetric.
Cyanide, total, milligrams per liter.	Distillation followed by automated colorimetric - Chloramine T titration or ion-specific electrode.
Cyanide amenable to chlorination, milligrams per liter.	Distillation followed by silver nitrate titration or ion-specific electrode.
Dissolved oxygen, milligrams per liter.	Winkler (Azide modification) or electrode method.
Fluoride, milligrams per liter.	Ion electrode.
Hardness--Total, as CaCO_3 , milligrams per liter.	EDTA titration.
Hydrogen ion (pH), pH units.	Electrometric measurement.
Kjeldahl nitrogen (as N), milligrams per liter.	Digestion and distillation followed by titration.

METALS

Aluminum--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Eriochrome Cyanine R).
Aluminum--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced methods for total aluminum.
Antimony--Total, milligrams per liter.	Digestion followed by atomic absorption.
Antimony--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total antimony.
Arsenic--Total, milligrams per liter.	Digestion followed by silver diethyldithiocarbamate; or atomic absorption.
Arsenic--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total arsenic.
Barium--Total, milligrams per liter.	Digestion followed by atomic absorption.
Barium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total barium.

<u>Parameter and Units</u>	<u>Method</u>
Beryllium--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Aluminon).
Beryllium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total beryllium.
Boron--Total, milligrams per liter.	Colorimetric (Curcumin).
Boron--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total boron.
Cadmium--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Dithizone).
Cadmium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total cadmium.
Calcium--Total, milligrams per liter.	Digestion followed by atomic absorption; or EDTA titration.
Calcium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total calcium.
Chromium VI, milligrams per liter.	Colorimetric (Diphenylcarbazide).
Chromium VI--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for chromium VI.
Chromium--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Diphenylcarbazide).
Chromium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total chromium.
Cobalt--Total, milligrams per liter.	Digestion followed by atomic absorption.
Cobalt--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total cobalt.
Copper--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Neocuproine).
Copper--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total copper.
Gold--Total, milligrams per liter.	Digestion followed by atomic absorption.

<u>Parameter and Units</u>	<u>Method</u>
Iridium--Total, milligrams per liter.	Digestion followed by atomic absorption.
Iron--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Phenanthroline).
Iron--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total iron.
Lead--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Dithizone).
Lead--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total lead.
Magnesium--Total, milligrams per liter.	Digestion followed by atomic absorption; or gravimetric.
Magnesium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total magnesium.
Manganese--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Persulfate or periodate).
Manganese--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total manganese.
Mercury--Total, milligrams per liter.	Flameless atomic absorption.
Mercury--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total mercury.
Molybdenum--Total, milligrams per liter.	Digestion followed by atomic absorption.
Molybdenum--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total molybdenum.
Nickel--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Heptoxime).
Nickel--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total nickel.
Osmium--Total, milligrams per liter.	Digestion followed by atomic absorption.

<u>Parameter and Units</u>	<u>Method</u>
Palladium--Total, milligrams per liter.	Digestion followed by atomic absorption.
Platinum--Total, milligrams per liter.	Digestion followed by atomic absorption.
Potassium--Total, milligrams per liter.	Digestion followed by atomic absorption, colorimetric (Cobaltinitrite) or by flame photometric.
Potassium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total potassium.
Rhodium--Total, milligrams per liter.	Digestion followed by atomic absorption.
Ruthenium--Total, milligrams per liter.	Digestion followed by atomic absorption.
Selenium--Total, milligrams per liter.	Digestion followed by atomic absorption.
Selenium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total selenium.
Silica--Dissolved, milligrams per liter.	0.45 micron filtration followed by colorimetric (Molybdosilicate).
Silver--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Dithizone).
Silver--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total silver.
Sodium--Total, milligrams per liter.	Digestion followed by atomic absorption or by flame photometric.
Sodium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total sodium.
Thallium--Total, milligrams per liter.	Digestion followed by atomic absorption.
Thallium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total thallium.
Tin--Total, milligrams per liter.	Digestion followed by atomic absorption.

Tin--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total tin.
Titanium--Total, milligrams per liter.	Digestion followed by atomic absorption.
Titanium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total titanium.
Vanadium--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Gallic acid).
Vanadium--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total vanadium.
Zinc--Total, milligrams per liter.	Digestion followed by atomic absorption or by colorimetric (Dithizone).
Zinc--Dissolved, milligrams per liter.	0.45 micron filtration followed by referenced method for total zinc.
Nitrate (as N), milligrams per liter.	Automated cadmium reduction.
Nitrite as N, milligrams per liter.	Automated colorimetric.
Oil & grease, milligrams per liter.	Liquid-liquid extraction with trichlorotrifluoroethane-gravimetric or infrared spectroscopy.
Organic carbon; total (TOC), milligrams per liter.	Combustion--infrared method.
Organic nitrogen (as N), milligrams per liter.	Kjeldahl nitrogen minus ammonia nitrogen.
Orthophosphate (as P), milligrams per liter.	Automated ascorbic acid reduction.
Phenols, milligrams per liter.	Colorimetric, (4AAP).
Phosphorus; total (as P), milligrams per liter.	Persulfate digestion followed by automated ascorbic acid reduction.

RESIDUE

Total, milligrams per liter.	Gravimetric, 103 to 105° C.
Total dissolved (filterable), milligrams per liter.	Glass fiber filtration, 180° C.

<u>Parameter and Units</u>	<u>Method</u>
Total suspended (nonfilterable), milligrams per liter.	Glass fiber filtration, 103 to 105° C.
Settleable, milliliters per liter or milligrams per liter.	Volumetric.
Total volatile, milligrams per liter.	Gravimetric, 550° C.
Specific conductance, micromhos per centimeter at 25° C.	Wheatstone bridge conductimetry.
Sulfate (as SO ₄), milligrams per liter.	Automated colorimetric (barium chloride).
Sulfide (as S), milligrams per liter.	Titrimetric--Iodine.
Sulfite (as SO ₃), milligrams per liter.	Titrimetric, iodine-iodate.
Surfactants, milligrams per liter.	Colorimetric (Methylene blue).
Temperature, degrees C.	Calibrated glass or electrometric thermometer.
Turbidity, NTU.	Nephelometric.
Ignitability, degrees C.	Closed cup flash tester.

ORGANICS

Endrin, mg/l	GC-ECD
Lindane, mg/l	GC-ECD
Methoxychlor, mg/l	GC-ECD
Toxaphene, mg/l	GC-ECD
2,4-D, mg/l	GC-ECD
2,4,5-TP Silvex, mg/l	GC-ECD
Acid Extractable Organics	GC/MS
Base/Neutral Extractable Organics	GC/MS
Volatile Organics	GC/MS
Acrolein & Acrylonitrile	GC-FID
Chlorinated Hydrocarbons	GC-ECD
Haloethers	GC-HECD
Nitroaromatics & Isopherone	GC-FID
Nitrosamines	GC-NPD
Organochlorine Pesticides & PCB	GC-ECD
Phenols	GC-FID/ECD

<u>Parameter and Units</u>	<u>Method</u>
Phthalate Esters	GC-ECD
Polynuclear Aromatic Hydrocarbons	LC-UV/Fluor.
Purgeable Aromatic Hydrocarbons	GC-FID
Purgeable Halocarbons	GC-HECD
Triazine Pesticides	GC-NPD
Trihalomethanes	GC-Conlson

SECTION XIII QUALITY CONTROL

GENERAL

All analysts practice quality control routinely. Routine quality control practices are established as part of every analytical measurement to assure reliability of final results. Every variable that can affect results is considered, evaluated and controlled; i.e., quality of reagent water, precision and accuracy of the analysis, daily performance of equipment and the analyst, and ongoing laboratory review.

Quality control requirements are met or exceeded for analyzing water as specified by pertinent certification requirements. All quality control data and performance records are maintained and available for inspection by the Client.

INTERLABORATORY QUALITY CONTROL

Interlaboratory quality control is maintained through certification by the Kansas Department of Health and Environment, the Oklahoma Water Resources Board, and the American Industrial Hygiene Association. Wilson Laboratories participates in all analysis and quality assurance programs which are a part of these certification requirements. Copies of certificates are appended.

The American Industrial Hygiene Association certification program requires the analyses of performance samples four times each year. In addition, an on-site certification is performed by an industrial hygienist site visitor prior to initial certification and recertification.

The Kansas certification encompasses water, wastewater and hazardous wastes analyses by standard wet and instrumental procedures, including GC/MS analysis of priority pollutants. The certification requirements include on-site visits by certification officers, review of Quality Assurance practices and analysis of performance evaluation samples.

Performance evaluation samples are provided each six months by the Oklahoma Water Resources Board as a requirement for the Oklahoma certification.

A list of all parameters tested along with the results of the most current test rounds is appended.

Results of the intralaboratory control results are evaluated by the Laboratory Director and Quality Control Coordinator, with appropriate action taken if necessary. This action generally constitutes a stop-work order on the method of concern until Quality Assurance is assured.

Wilson Laboratories has consistently proven proficiency in all areas tested.

INTRALABORATORY QUALITY CONTROL

Intralaboratory quality assurance is performed as described in the Handbook for Analytical Quality Control in Water and Wastewater Laboratories (EPA-600/4-79-019), Manual of Analytical Quality Control for Pesticides in Human and Environmental Media (EPA-600/1-76-017) and the American Industrial Hygiene Association (AIHA) Quality Control Manual. Shewhart quality control charts for precision and accuracy have been developed and are used to ensure data reliability in accordance with the AIHA and the EPA manuals. Tabulated quality control data are reviewed by the Quality Control Officer and the analyst. Each analyst is provided with a quality control number which identifies him with each analysis he performs.

Duplicate samples are run for every tenth analysis of any given constituent. If any difference between duplicate analyses exceeds the critical range value, then analyses are stopped until the problem is identified and resolved. After resolution, the problem and its solution are documented, and all analyses since the last in-control check are repeated or discarded. A known amount of standard sample of the constituent of interest is added on a 1:1 concentration basis to every tenth analysis of any given parameter. In applying the accuracy control chart, either of the following two conditions would indicate an out-of-control situation:

- a. Any point beyond the control limits.
- b. Seven successive points on the same side of the average percent recovery line.

When an out-of-control situation occurs, analyses are stopped until the problem has been identified and resolved. The problem and its solution are documented, and all analyses since the last in-control point are repeated or discarded.

GC/MS QUALITY CONTROL

Gas Chromatograph/Mass Spectrometer analyses for priority pollutants are performed in accordance with EPA Methods 624, Volatile Organics and 625, Base/Neutrals, Acids and Pesticides published in the Federal Register, Vol. 44, No. 233, Monday, December 3, 1979. Details of the quality control procedures are discussed below.

a. Sample Preparation. The extraction procedure is critical to the quality of the work produced by Wilson Laboratories. Technicians are thoroughly trained in the specific extraction and cleanup procedures to be used, as well as proper utilization and maintenance of the Kuderna-Danish glassware.

b. Mass Calibration. At the beginning of each eight hour shift the mass calibration of the system is checked by injecting a solution of BFB, if volatiles are being analyzed, or DFTPP if extractable analyses are to be performed. Key ions and ion abundance criteria are listed in table 1. A listing of the calibration ions is retained as documentation that the calibration was performed and was within specifications.

c. Analyte Calibration. The GC/MS system is initially calibrated at a minimum of three concentrations of all of the priority pollutants to determine response factors as described in Section 6 of Method 624 or 625. Once the initial calibration has been performed, the calibration is verified at least once per eight hour shift by analyses of representative compounds from each fraction. If the mean percent change for these calibration check compounds is greater than twenty percent, the system is recalibrated using a minimum of three concentrations for each compound. Response factors for the calibration check compounds are recorded daily and monitored for signs of change in the performance of the system.

$$\text{Percent Change} = \frac{\text{RF Check} - \text{RF initial}}{\text{RF initial}} \times 100\%$$

d. Surrogate Standards. Before each sample is extracted a minimum of two surrogate standards are added to produce a final concentration of 50 µg/l. The sample is then processed through the entire procedure including GC/MS analyses. The percent recovery of the surrogate standards serves as a check on the analytical procedure including sample preparation and quantitative GC/MS analyses. If the recovery of the surrogate standard shows a deviation greater than two standard deviations, the data are suspect and supervisory personnel must investigate the cause of the error.

e. Blank Analyses. A reagent blank analysis is performed either once per sample set or once per 20 samples and whenever a new lot of reagents is utilized in the analyses. If priority pollutants are detected in the blank, no analyses are performed until the source of the contamination can be determined.

f. Replicate Analyses. A minimum of one in twenty samples is a duplicate analyses. The results of this analysis give a value for the precision of the method under normal operating conditions.

g. Spike Samples. A minimum of one in twenty samples is spiked with a mixture of priority pollutants and analyzed in the same manner as other samples. The percent recovery for each compound is calculated to provide an indication of the accuracy of the method for priority pollutant analyses under typical operating conditions.

h. Outliers. Outliers are defined as any result greater than three standard deviations from the mean ($R \pm 3S$) for both duplicate and spiked results. Corrective action for outliers involves one or more of the following: reparation and reanalysis, recalculation of the sample based on alternate ions, preparation of new standards, and recalibration of the instrument. Documentation of the corrective action is included in the laboratory notebook.

Table 1 DFTPP/BFB Key Dons and Abundance Criteria

<u>Mass</u>	<u>Specifications - DFTPP</u>
51	30 to 60 percent of mass 198
68	Less than 2 percent of mass 69
70	Less than 2 percent of mass 69
127	40 to 60 percent of mass 198
197	Less than 1 percent of mass 198
198	Base peak, 100 percent relative abundance
199	5 to 9 percent of mass 198
275	10 to 30 percent of mass 198
365	Greater than 1 percent of mass 198
441	Present but less than mass 443
442	Greater than 40 percent of mass 198
443	17 to 23 percent of mass 442
<u>Mass</u>	<u>Specifications - BFB</u>
50	50 to 40 percent of mass 95
75	30 to 60 percent of mass 95
95	Base peak, 100 percent relative abundance
96	5 to 9 percent of mass 95
173	Less than 2 percent of mass 174
174	Greater than 50 percent of mass 95
175	5 to 9 percent of mass 174
176	Greater than 95 and less than 101 percent of mass 174
177	5 to 9 percent of mass 176

i. Archival Storage. All GC/MS sample data are stored on 9 track magnetic tape in EPA readable format. The archival storage of data allows samples to be re-analyzed at any time, providing proof of previous identifications, and the ability to search for other non-priority pollutant compounds.

SECTION XIV
SUMMARY

Quality Assurance procedures for water and wastewater chemical and physical analyses at Wilson Laboratories are summarized below:

- a. Verify calibration curves.
- b. Confirm instrumental calibrations (wavelength, temperatures, etc.)
- c. Monitor precision by performing replicate analyses on 10 percent of the samples processed.
- d. Document accuracy by adding known standard solutions to 10 percent of samples processed; determine percent recovery of the additions.
- e. Use an internal laboratory standard to trace performance of a given analytical method; match matrix as closely as possible to sample(s).
- f. Analyze externally prepared reference samples (NIOSH, Kansas, Oklahoma).
- g. Analyze externally prepared performance samples (unknown) from (NIOSH, Kansas, Oklahoma).
- h. Develop quality control charts for precision and accuracy performance; use charts to monitor daily laboratory performance.
- i. Develop correlation data between analyses of similar meaning and use as cross-checks on validity of results (e.g., conductivity and total dissolved solids; turbidity and total suspended solids; total organic carbon [TOC] and BOD/COD [chemical oxygen demand], etc.).
- j. Consult files of previous data from the same natural water sources; determine ranges and orders of magnitude; if significant differences are noted, interpret terms of natural processes, pollution or the possibility of analytical error or contamination.
- k. Calibrate analytical balances when irreproducibility is noted; service balances on an annual basis.
- l. Rotate chemical inventory to eliminate older chemicals and reagents.
- m. Develop replacement schedule for standard solutions; discard sooner if calibration curves change and change cannot be related to instrumental variation.
- n. Develop instrument maintenance records; enter all service, adjustments, etc., including problem diagnosis and resolution; indicate if data were reported when instrument was out of calibration; if so, explain disposition of the data.

- o. Calibrate thermometers with an NBS-certified thermometer.
- p. Validate all data entered into computer storage and retrieval systems.
- q. Record data in bound notebooks; institute supervisory acceptance of data prior to release from the laboratory.
- r. Scan current literature to maintain awareness of research progress and technical aids; subscribe to EPA documents, including the EPA Analytical Quality Control Newsletter.

INDIVIDUAL RESUMES

EDUCATION

- University of Cincinnati — B.S. in Chemical Engineering — 1949
- University of Cincinnati — Professional Chemical Engineering — 1958
- U.S. Army Schools, Graduate Diploma:
 - The Ground General School — 1949-50
 - The Artillery School — 1950-51
 - Ordnance Technological Course — 1951-52

REGISTRATIONS

- Professional Engineer in Arkansas, Arizona, California, Colorado, Georgia, Illinois, Kansas, Maryland, Missouri, Nebraska, New Mexico, New York, Oklahoma and Texas

PROFESSIONAL AFFILIATIONS

- American Chemical Society
- American Institute of Chemical Engineers
- American Water Works Association
- National Society of Professional Engineers
- Water Pollution Control Federation
- American Academy of Environmental Engineers (Diplomate)
- National Association of Corrosion Engineers
- National Water Supply Improvement Association
- American Society for Testing Materials
- Air Pollution Control Association

PATENTS

- U.S. Patent 3,027,321 — Chromate Reduction Process
- U.S. Patent 3,607,482 — Recovery of Aluminum Chemical Milling Solutions
- U.S. Patent 4,350,597 — Apparatus and Process for Treatment of Sludge

EXPERIENCE

Prior to the establishment of Wilson Laboratories in 1954, Mr. Selm was a regular officer for five years in the U.S. Army Ordnance Corps. After organizing Wilson Laboratories, Mr. Selm acted as Laboratory Director until 1973. Wilson Laboratories was organized to provide accurate analytical results in the areas of: water and wastewater control, general analyses of fuels, oils and lubricants, trace metal analysis, analysis of priority pollutants, industrial solvents, pesticides, industrial gases, general process development and research for water pollution control methodology, development of analytical methods and procedures, analysis of air monitoring, OSHA compliance testing, and industrial hygiene consultation and analysis.

Mr. Selm has authored or co-authored a number of technical articles and publications, and has prepared numerous reports and consulting recommendations on the chemical and chemical engineering field.

ADDITIONAL PROFESSIONAL ACTIVITIES

Mr. Selm has been the Chairman of the State KES Environmental Resources Committee since 1968, and served on the Kansas State Board of Health's Solid Waste Advisory Council, which drafted the Regulations for Implementation of the State's Solid Waste Act.

STEPHEN E. ASCHER, P.E.
Associate
Laboratory Director

EDUCATION

- Kansas Wesleyan — B.A. in Chemistry — 1965
- Kansas State University — Process Control School — 1969
- U.S. Bureau of Mines — Noise Measurement Course — 1971
- SM Institute — Dynamics of Motivational Management — 1972
- U.S. Bureau of Reclamation — Ozone Symposium — 1974
- U.S. Environmental Protection Agency — St. Louis, Missouri — Disposal of Sludge on Land — 1976
- Kansas State University — Industrial Waste System Seminar — 1976

REGISTRATIONS

- Professional Engineer in Kansas

EXPERIENCE

Mr. Ascher joined the Company in 1964 as a chemical laboratory technician specializing in water and sewage chemistry. He continued in this capacity until August 1965. After completing his military service, he rejoined the firm in 1966, became an Engineer-In-Training in 1968, and was granted his professional engineering license in 1973.

He has extensive process design experience in biological and chemical treatment plants for industrial and municipal wastewater. He also has extensive process design experience in municipal water treatment plants. Mr. Ascher served as project engineer, responsible for process design, design concepts, design, specifications and cost analysis on a large number of projects.

He is experienced in piping and hydraulic design, cost analysis, construction observation and plant operations troubleshooting. He has also acquired considerable experience in industrial and municipal wastewater surveys, data collection and analysis, coordination of sampling programs, preparation of operating manuals and operator training, plant startup and plant operation.

Mr. Ascher became an Associate with the Company and Laboratory Director in 1984. As Laboratory Director, he exercises technical and administrative control for all programs within the Laboratory. He also assists with the definition of chemical processes in industrial process systems, and in the development of specific design methods for industrial water and wastewater systems.

Mr. Ascher has provided leadership and technical direction for the following major laboratory projects:

- Lockheed-Georgia Company — Marietta, Georgia: Laboratory pilot tests of aluminum chemical milling etchant system
- Grumman Aerospace Corporation — Bethpage, New York: Development of laboratory reactors for aluminum chemical milling etchant recovery system
- CRA, Inc. — Coffeyville and Phillipsburg, Kansas: Sampling and field flow measuring of refinery process wastes and storm water runoff
- Getty Refining and Marketing Company — El Dorado, Kansas: Dirty water, non-steady state aerator test in a 4.5 million gallon aeration tank
- Central Illinois Public Service Company — Newton and Hulsomville, Illinois: Sampling and effluent flow measurement on large steam generator plants
- General Electric Company — Albuquerque, New Mexico: Air and water pollution sampling and analyses
- LTV Aerospace Corporation — Grand Prairie, Texas: Field laboratory operations for major water pollution control survey
- Iowa Beef Packers — Dakota City, Nebraska: Industrial hygiene analyses for beef slaughtering operation
- City of Roswell, New Mexico: Field pilot test and laboratory analyses for experimental wastewater treatment system
- Tri-County Water Association — Eagle Butte, South Dakota: Set up laboratory, establish laboratory procedures and train chemists for a large rural water supply district
- City of Russell, Kansas: Re-equip water treatment plant laboratory, establish laboratory procedures and train chemists for a small municipal water treatment plant

EDUCATION

- Goshen College — B.A. in Biology — 1968
- University of Iowa — M.S. in Chemistry — 1979

PROFESSIONAL AFFILIATIONS

- American Chemical Society
- American Industrial Hygiene Association

EXPERIENCE

Mr. Newcomer joined Wilson Laboratories in 1981 with 13 years of high school and college teaching experience in chemistry and biology. In this position, he was responsible for both classroom and laboratory management, and was instrumental in the curriculum department. He was presented the Outstanding Young Educator Award in 1974, and was also awarded a National Science Foundation grant in 1978.

As Chief Chemist, Mr. Newcomer provides technical expertise in all areas of analytical chemistry including method development, proper laboratory techniques, data review and quality control procedures. His management responsibilities for the general analytical laboratory include the supervision and training of laboratory technicians and coordination of work assignments.

Mr. Newcomer acts as Project Manager for numerous laboratory projects. He has held this responsibility for the following major projects:

- Waste Management Incorporated — Furley, Kansas: Groundwater Monitoring, field sampling and analysis
- Woodward-Clyde Consultants — Furley, Kansas: Air monitoring and analysis at a hazardous waste landfill facility
- Bendix Corporation — Kansas City, Missouri: General Analytical Services, wastewater analysis
- USDA — Washington D.C.: Adulteration of foods
- Mobile Traveler Motor Homes — Junction City, Kansas: Hazardous Waste Characterization
- Hill Air Force Base — Ogden, Utah: Hazardous Waste Characterization
- Abbott Laboratories — Wichita, Kansas: Groundwater Monitoring, NPDES analysis
- AMOCO — Sugar Creek, Missouri: Groundwater Monitoring and Hazardous Waste Analysis

BRUCE T. FAST
Chief of Spectroscopy Laboratory

EDUCATION

- University of Colorado, Boulder — B.A. in Chemistry — 1971
- University of Northern Colorado — M.S. in Science Education — 1974
- Perkin Elmer Atomic Absorption School — 1975
- Perkin Elmer Atomic Absorption and Data Management School — 1981

PROFESSIONAL AFFILIATIONS

- American Chemical Society

EXPERIENCE

Mr. Fast joined Wilson Laboratories as an Analytical Chemist in 1975. He is in charge of the Spectroscopy Laboratory and is responsible for all metals analysis by atomic absorption.

Mr. Fast has extensive experience in the operation of a variety of atomic absorption instrumentation, including computer-operated AA. This includes determination of metals in industrial hygiene samples, potable water, groundwater, lubricating oil, rock, air, soil, industrial waste and biological samples.

In addition to his broad atomic absorption background, he also has experience in infrared analysis and gas chromatographic experience. He has performed numerous industrial hygiene surveys for airborne contaminants at industrial facilities.

Mr. Fast has been involved in the following representative major projects at Wilson Laboratories:

- National Cash Register Corporation — Wichita, Kansas: Analysis of waste materials for metals
- Derby Refining Company — Wichita, Kansas: Groundwater analysis for metals
- Chevron Resources Company — Creede, Colorado: Groundwater analysis for metals
- General Battery Corporation — Salina, Kansas: Blood Lead Analysis, Industrial Hygiene
- Westinghouse Electric Corporation — Salina, Kansas: Mercury in urine analysis; Industrial Hygiene
- Kansas Power & Light Company — State of Kansas: Mercury in urine analysis; Industrial Hygiene
- Memorial Hospital — Topeka, Kansas: Asbestos in air sampling
- Sherwin-Williams Chemicals Corporation — Coffeyville, Kansas: Airborne heavy metals sampling and analysis
- University of North Dakota: 15-month air quality analysis
- Bendix Corporation — Grand Junction, Colorado: Soil and rock analysis
- Vulcan Materials Company — Wichita, Kansas: Waste treatment pilot studies for concentrated organic wastes by extraction procedures
- Vulcan Materials Company — Wichita, Kansas: Pilot study involving high-pressure hydrodechlorination of concentrated chlorinated hydrocarbons and chlorinated phenols
- Vulcan Materials Company — Wichita, Kansas: Waste treatment pilot studies for decomposition of dilute chlorinated organic wastes by Ozone/UV treatment
- Vulcan Materials Company — Geismar, Louisiana: Pilot studies for biological activated sludge degradation of sodium formate containing brine waste
- Schuykill Metals Corporation — Forest City, Missouri: Groundwater analysis for metals
- Amoco Refining Company — Sugar Creek, Missouri: Groundwater analysis for metals
- Waste Management, Inc. — Kansas: Analysis of 350 samples of groundwater and lagoon water for eight heavy metals at NIES Hazardous Waste Sites
- Environmental Protection Agency — Various Sites: Analysis of varying matrices for 20 metals

EDUCATION

- Bemidji State University — B.S. in Environmental Studies — 1981

PROFESSIONAL AFFILIATIONS

- American Industrial Hygiene Association
- National Safety Council

EXPERIENCE

Ms. Moles joined Wilson Laboratories after graduation from college. She has specialized in metals analysis by atomic absorption spectroscopy. Ms. Moles is experienced in the use of Perkin-Elmer atomic absorption spectrophotometers Models 5000 and 503. She is proficient in the use of flame and furnace autosamplers on the 5000, furnace autosampler and hydride generation techniques on the 503, and mercury analyses using the cold vapor technique. The Perkin-Elmer 5000 is operated in conjunction with the model 3600 Data Station, a microcomputer.

Ms. Moles has participated in the following representative major projects at Wilson Laboratories:

- U.S. Environmental Protection Agency — Various Sites: Two-year Superfund contract for inorganic analyses
- Waste Management, Inc. — Wichita, Kansas: Heavy metals analyses for hazardous waste sites
- Midwest Hazardous Waste Landfill Groundwater Study — Various Sites: Analysis of 120 samples for heavy metals
- General Battery Corporation — Salina, Kansas: Blood lead and airborne lead analyses (quarterly analysis of 100 samples) — industrial hygiene
- Amoco Refining Company — Sugar Creek, Missouri: Groundwater analysis for metals
- Schuykill Metals Corporation — Forest City, Missouri: Groundwater analyses for metals
- Industrial Waste Analysis for Hazardous Waste Landfilling — Various Sites: Heavy metals analyses for more than 200 clients

CLIFFORD J. BAKER
Chief of Chromatography Laboratory

EDUCATION

- University of Pittsburgh — B.S. in Chemistry — 1976
- Kansas State University — Post Graduate Studies in Chemistry
- Perkin-Elmer High Pressure Liquid Chromatography School — 1980
- Finnigan Institute Gas Chromatography/Mass Spectrometry Operation and Priority Pollutant Analysis Courses — 1981

PROFESSIONAL AFFILIATIONS

- American Chemical Society

EXPERIENCE

Mr. Baker joined Wilson Laboratories in 1976. He specializes in gas chromatography and high-pressure liquid chromatography analyses, using all of the currently available detection systems, and in gas chromatography/mass spectrometry (GC/MS) analysis utilizing a Finnigan OWA-30 System.

The Laboratory performs analyses for all categories of priority pollutants, and participated in seven EPA method development studies for organic priority pollutants. Mr. Baker was the chief organic chemist associated with these projects.

He is experienced in organic analysis in a wide variety of media, including groundwater, air, soil, sludges, potable water, wastewater, oils and plant and animal tissue.

Mr. Baker has performed developmental work on a wide variety of gas chromatographic determinations, including low levels of pentachlorophenol in fish tissues, PCB's in casting wax, extraction, clean-up, derivatization and analysis techniques for amines, chlorophenols, chlorinated pesticides and haloalkanes in water. He has developed procedures for the trace analysis of explosive compounds in wastewaters by HPLC procedures in connection with Corps of Engineers contracts.

Mr. Baker has performed organic analysis for the following representative major projects:

- Midwest Hazardous Landfill Groundwater Study: 350 GC/MS complete priority pollutant scans
- Vulcan Materials Company — Wichita, Kansas: Groundwater and process wastewater analyses for halogenated phenols, pesticides and volatiles
- Abbott Laboratories — Wichita, Kansas: Groundwater and process wastewater analyses for cyclic amine compounds, utilizing capillary GC with nitrogen detection
- Corps of Engineers — Independence, Missouri: Wastewater analysis and treatability studies for explosive compounds by HPLC
- Midwest Pesticide Formulator: Method development and GC/LC analysis for chlorinated pesticides and herbicides

EDUCATION

- Marymount College of Kansas — B.S. in Chemistry — 1980
- University of Nebraska — M.S. in Chemistry — 1983

PROFESSIONAL AFFILIATIONS

- American Chemical Society

EXPERIENCE

Mr. Splichal joined Wilson Laboratories in 1983. His thesis work at the University of Nebraska involved the kinetics of the oxidation of amines and related compounds with ferrate ion. He is experienced in gas chromatographic and spectrophotometric analysis procedures.

Mr. Splichal's work at the Laboratory is principally in the area of organic priority pollutant analysis utilizing gas chromatography.

Representative projects include:

- U.S.D.A. — Washington, D.C. — Rennet whey in powdered milk by HPLC
- Waste Management, Inc. — Wichita, Kansas: Organics analysis for hazardous waste sites
- Abbott Laboratories — Wichita, Kansas: Groundwater and process wastewater analysis for cyclic amine compounds

BERNADINE K. SIEMENS
Laboratory Administrative Officer
Chemist

EDUCATION

- Marymount College — B.S. in Chemistry — 1984
- Norwalk, Connecticut — Perkin-Elmer Corporation
LIMS/2000 Key Personnel Training — 1984

EXPERIENCE

Ms. Siemens joined Wilson Laboratories in 1975 as a Laboratory Technician. She is experienced in every facet of the laboratory operation, and has performed a wide variety of general chemical analyses. Ms. Siemens supervises the administrative section, coordinates purchasing and billing activities and is responsible for computer operations.

In 1979, she assumed administrative duties for the Laboratory while continuing to perform as a Chemical Technician. Since 1981 she has been responsible for sample tracking and work schedules in the laboratory, from sample receipt to final report. She was actively involved in the development of the computerized information management system. Ms. Siemens developed the database structure for the Perkin-Elmer LIMS mainframe computer system installed in June 1983.

She has held project responsibility for various analytical programs including the following major projects:

- EPA Inorganics Superfund Contract — Hazardous Waste
- Hercules Aerospace Division — Analysis of Industrial Wastewater
- Schuykill Metals — Groundwater Analysis
- Resource Engineering — Priority Pollutant Analyses
- EPA Special Analytical Services
- Engineering Enterprises — Monitor Well and Groundwater Analysis

LABORATORY CERTIFICATES



STATE OF KANSAS

DEPARTMENT OF HEALTH AND ENVIRONMENT

Certificate

This is to certify that WILSON LABORATORIES
SALINA, KANSAS has been
approved in accordance with K.S.A. 66-171k for performing the
following analyses on drinking water and/or pollution control samples.

Microbiology (Total and Fecal Coliform by Membrane Filtration), Acid Extract (GC/MS), Acrocin and Acrylonitrile (O.C.) Alkalinity, Aluminum (Al), Ammonia, Antimony (Sb), Arsenic (As), Barium (Ba), Base/Neutral Extract (GC/MS), Beryllium (Be), Biochemical Oxygen Demand, Boron (B), Bromide, Cadmium (Cd), Calcium (Ca), Chemical Oxygen Demand, Chloride, Chlorinated Hydrocarbons (O.C.), Chlorinated Hydrocarbon Pesticides, Chlorine, Chlorophenoxy Acid Herbicides, Chromium (Cr, Total & Hexavalent), Cobalt (Co), Specific Conductivity, Copper (Cu), Cyanide, Dissolved Oxygen, Fluoride, Haloethers (O.C.), Hardness, Iron (Fe), Kjeldahl Nitrogen, Lead (Pb), Magnesium (Mg), Manganese (Mn), Mercury (Hg), Molybdenum (Mo), Nickel (Ni), Nitrate/Nitrite, Nitroaromatics & Isophenone (O.C.) Nitrosamines (O.C.), Oil & Grease, Orthophosphate, pH, Phenols (4AAP & O.C.), Total Phosphorus, Phthalate Esters (O.C.), Polychlorinated Biphenyls, Polynuclear Aromatics (H.P.L.C.), Potassium (K), Purgeable Aromatics (O.C.), Purgeable Halocarbons (O.C.) Purgeables (GC/MS), Selenium (Se), Silicon (Si), Silver (Ag), Sodium (Na), Total Solids, Total Dissolved Solids, Total Suspended Solids, Sulfate, Sulfide, Sulfite, Surfactants (M.B.A.S.), Temperature, Thallium (Tl), Tin (Sn), Thallium (Tl), Total Organic Carbon, Trihalomethanes, Turbidity, Vanadium (V), and Zinc (Zn)

Certificate No. 7-191 Date Issued 7-1-84 Expiration Date 7-31-85

Barbara J. Schel
Secretary Department of Health and Environment

R. A. E. J.
Environmental Laboratory Certification Officer

**OKLAHOMA
WATER
RESOURCES
BOARD**

Hereby Recognizes That

Wilson Laboratories

Laboratory No. 7204

is a participant in the Oklahoma Water Resources Board's LABORATORY CERTIFICATION PROGRAM and maintains on file a List of Parameters for which it is certified to perform analyses.



Done this 9th day of June, 1981


James R. McPart Executive Director

This certificate is valid only for JULY 1 through DECEMBER 31
1984

AMERICAN INDUSTRIAL HYGIENE ASSOCIATION

Industrial Hygiene Laboratory Wilson Laboratories Salina, Kansas

has fulfilled AIHA criteria for
Industrial Hygiene Laboratory Accreditation
since February, 1980

This accreditation shall be effective until
the 1st day of February, 1986
subject to continued compliance with
AIHA accreditation criteria.

John E. Dignity
Chairman
Laboratory Accreditation
Committee

141
Accreditation Number

Charles Powell
President
American Industrial Hygiene
Association

November 18, 1983
Date

Wilson Laboratories provides comprehensive industrial hygiene services, specializing in industrial hygiene chemical analyses. In-plant survey capabilities include:

- Monitoring for dusts, fibers, fumes and heavy metals
- In-plant noise and vibration measurements
- Personnel monitoring for heavy metals in blood and urine

Feasibility studies, reports and facility design are included in Wilson Laboratories' comprehensive services. Liaison with regulatory agencies at the Federal, State and local levels is also provided.

INTERLABORATORY
PERFORMANCE SAMPLE RESULTS

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT
PERFORMANCE SAMPLE RESULTS
FOR 1982-1983 CERTIFICATION

<u>Parameter</u>	<u>Reported Value</u> ₁	<u>True Value</u> ₁	<u>Acceptable Range</u> ₁	<u>Proficient</u>	<u>Non-Proficient</u>
COD	211	222	182-244	X	
BOD ₅	90.0	95.6	63.5-138.	X	
TOC	68.0	87.	64.5-106.	X	
Ammonia as N	0.21	0.13	0.008-0.284	X	
Nitrate as N	0.15	0.15	0.118-0.245	X	
Orthophosphate as P	ND(0.1)	0.014	0.0-0.073	X	
Kjeldahl Nitrogen	ND(1.0)	0.27	0.0-0.739	X	
Total Phosphorus	1.21	1.06	0.428-1.64	X	
pH	8.55	8.4	7.56-8.71	X	
Spec. Cond., µmho/cm	514.	505.	340.-636.	X	
TDS	325.	298.	246.-370.	X	
TSS	25.0	29.5	12.1-50.0	X	
Hardness	127.	123.	103.-140.	X	
Calcium	32.5	34.2	20.8-45.8	X	
Magnesium	10.0	9.2	5.28-12.7	X	
Sodium	40.5	41.7	31.1-51.4	X	
Potassium	7.63	7.9	4.96-11.2	X	
Alkalinity	76.3	79.3	65.4-88.3	X	
Chloride	78.	75.3	64.7-87.5	X	
Fluoride	2.12	1.9	1.46-2.34	X	
Sulfate	78.	80.3	63.6-92.0	X	
Oil and Grease	17.4	12.0	8.06-27.7	X	
Cyanide, µg/l	187.	171.	107.-224.	X	
Phenol (4AAP), µg/l	66.7	68.	60.17-75.83	X	
Aluminum, µg/l	56.	60.	14.9-164.	X	
Arsenic, µg/l	18.	22.	11.4-34.1	X	
Barium, µg/l	370.	391.	242.-518.	X	
Beryllium, µg/l	30.	30.	3.48-35.6	X	
Cadmium, µg/l	3.2	2.5	0.0-6.54	X	
Cobalt, µg/l	20.	20.	4.23-37.6		

1. All units are mg/l unless otherwise noted.

<u>Parameter</u>	<u>Reported Value₂</u>	<u>True Value₂</u>	<u>Acceptable Range₂</u>	<u>Profi- cient</u>	<u>Non-Pro- ficient</u>
Chromium	10.5	10.	0.0-23.1	X	
Copper	11.	11.	0.0-27.1	X	
Iron	46.	20.	0.0-69.7	X	
Mercury	0.40	0.75	0.163-1.38	X	
Manganese	19.	15.	0.0-34.5	X	
Nickel	54.	30.	0.0-64.7	X	
Lead	25.	24.	4.33-48.1	X	
Selenium	9.2	6.	1.06-11.4	X	
Silver	ND(0.1)	0.0	0.0-0.0	X	
Vanadium	73.	70.	0.0-207.	X	
Zinc	20.	16.	0.0-42.6	X	
Aldrin	0.038	0.056	0.025-0.070	X	
Dieldrin	0.128	0.114	0.070-0.160	X	
DDD	0.149	0.170	0.100-0.230	X	
DDE	0.028	0.013	D.L. - .043	X	
DDT	0.111	0.156	0.110-0.190	X	
Heptachlor	0.015	0.028	D.L.-0.034	X	
Chlordane	1.08	1.04	0.58-1.20	X	
Arachlor 1016	ND(1.0)	0.0	0.0-0.0	X	
Arachlor 1254	1.45	2.18	0.235-3.46	X	
Total P.C.B.	1.45	2.18	0.235-3.46	X	
Chloroform	65.3	74.0	59.7-90.0	X	
Bromoform	9.31	8.2	6.56-9.84	X	
Bromodichloro Methane	8.9	9.4	7.52-11.28	X	
Chlorodibromo Methane	31.2	45.1	30.08-54.12	X	
Total T.H.M.	114.7	136.7	109.4-164.0	X	
Endrin	0.448	0.4	0.034-0.738	X	
Lindane	0.051	0.065	0.0-1.38	X	
Methoxychlor	0.748	0.62	0.0-5.25	X	
Toxaphene	4.14	4.4	0.0-13.0	X	

2. All values are µg/l unless otherwise noted.

NIOSH PROFICIENCY ANALYTICAL TESTING (PAT) PROGRAM

PERFORMANCE SAMPLE RESULTS

ROUND 77 MAY 1984

<u>Parameter</u>	<u>Reported Value</u>	<u>True Value (Arithmetic Mean)</u>	<u>Relative Standard Deviation</u>	<u>Pro- ficient</u>	<u>Non-Pro- ficient</u>
Lead	0.0386 mg	0.0384	4.3%	X	
	0.0155	0.0151	5.8%		
	0.0502	0.0489	3.6%		
	0.0254	0.0252	5.0%		
Cadmium	0.0051 mg	0.0049	5.3%	X	
	0.0078	0.0077	4.7%		
	0.0194	0.0190	4.4%		
	0.0111	0.0109	4.8%		
Zinc	0.0935 mg	0.0924	5.2%	X	
	0.1855	0.1811	5.1%		
	0.2060	0.2021	4.5%		
	0.1275	0.1233	4.6%		
Silica	0.0510 mg	0.0559	24.4%	X	
	0.0833	0.0795	20.8%		
	0.0794	0.0643	19.1%		
	0.0969	0.1154	19.0%		
Asbestos	0784.6 F/mm ²	0912.0	31.0%	X	
	0440.4	0707.0	32.0%		
	0114.8	0174.2	44.0%		
	0248.1	0478.7	33.1%		
Carbon Tetrachloride	0.6091 mg	0.6434	7.7%	X	
	0.9516	1.0048	6.9%		
	0.3616	0.3789	9.3%		
	0.5106	0.4856	9.0%		
1,2-Dichloro- ethane	0.9525 mg	0.9371	5.6%	X	
	0.9850	1.0384	6.9%		
	0.6249	0.6204	6.4%		
	0.7457	0.7299	5.9%		
Trichloro- ethylene	1.2390 mg	1.1927	6.0%	X	
	0.9663	0.9862	7.2%		
	1.8025	1.7944	6.4%		
	1.3853	1.3739	6.5%		

OKLAHOMA WATER RESOURCES BOARD
PERFORMANCE SAMPLE RESULTS
FOR 1983 CERTIFICATION

<u>Parameter</u>	<u>Reported Value</u>	<u>True Value</u>	<u>Acceptable Range</u>	<u>Proficient</u>	<u>Non- Proficient</u>
Hardness	306	314	292-336	X	
Chloride	167	160	147-173	X	
Sulfate	218	223	199-247	X	
Dissolved Solids	699	587	508-666	X	
Specific Conductance	950	948	863-1032	X	
Ammonia-Nitrogen	9.2	9.15	7.6-10.7	X	
Nitrate Nitrogen	15.2	15.2	12.0-18.4	X	
Total Phosphorus	13.6	13.4	11.6-15.2	X	
pH	1.70	1.79	1.5-2.1	X	
Aluminum	1.2	1.16	0.9-1.4	X	
Arsenic	0.12	0.116	0.06-0.17	X	
Barium	0.9	0.94	0.6-1.3	X	
Cadmium	0.232	0.235	0.211-1.260	X	
Calcium	57.	57.8	50.-66.	X	
Chromium	0.47	0.492	0.41-0.57	X	
Copper	0.48	0.487	0.42-0.56	X	
Lead	0.4	0.34	0.2-0.5	X	
Magnesium	41.	40.4	34.-47.	X	
Manganese	0.90	0.879	0.78-0.98	X	
Mercury	0.301	0.307	0.215-0.399	X	
Nickel	1.1	1.11	0.9-1.3	X	
Potassium	41.	41.8	35.-48.	X	
Selenium	0.770	0.755	0.516-0.994	X	
Sodium	65.	65.7	59.-73.	X	
Zinc	1.17	1.14	1.03-1.26	X	

SAMPLE TRACKING AND SCHEDULING FORMS

Samples of forms utilized by Wilson Laboratories for tracking samples and for scheduling work are described below:

1. Sample Test Data: Generated at log-in; contains all sample and client information.
2. List of All Order and Lab Numbers for Client: Generated at log-in; lists all orders and samples for a given client.
3. Schedule of Tests Due: Daily schedule for each analysis due. Note prep and due dates are included.
4. Schedule of Tests Due: Daily schedule for special preparations for samples, i.e., acid digestion.
5. Test Result Check Form: After test results are entered into the computer from the notebooks, this form is produced and is checked for accuracy against the notebook before the report is printed. Notebook and page number are printed on this form.

Quality control precision and accuracy data are recorded in the lab notebooks in colored ink at the time of analysis. Conformance to control limits is determined at the time of analysis and all data are reviewed daily by the Section Chiefs. Out of control tests are reported to the Q.A. officer and remedial action is taken immediately.

6. Final Report: After all checking is completed and accuracy of results is verified, the report is generated. All reports receive a final check by the project manager for completeness and reasonableness of the numbers. Lab Director reviews all reports and signs all reports.
7. Number of Tests Not Done in Group: Work load per group, i.e., all metals, or all tests.

FORM 1

SAMPLE TEST DATA

LAB NUMBER(S):

8206-0123

06/11/82

CLIENT NAME: EPA

STREET ADDRESS: P.O. BOX 15027

CITY AND STATE: LAS VEGAS, NEVADA 89114

CLIENT CONTACT: PAT LASKA

FILE NUMBER: LAB CERT

ORDER NUMBER: .2475

PURCHASE ORDER:

DATE RECEIVED: 06/04/82

DATE DUE: 06/10/82

SAMPLE LOCATION: 4-14

CONTAINER TYPE: 1 AMPULE, LRN

SAMP. DESC.: SAMPLE 1 METALS

DATE SAMPLED:

TIME SAMPLED:

SPEC. INS.: SEE WORKSHEET

TESTS ASSIGNED TO SAMPLE

115 ALUMINUM

125 ANTIMONY

126 ARSENIC

138 BARIUM

147 BERYLLIUM

154 BORON

169 CADMIUM

199 CHROMIUM, TOTAL

204 COBALT

210 COPPER

310 IRON, TOTAL

320 LEAD

330 MANGANESE

333 MERCURY

352 NICKEL

435 SELENIUM

440 SILVER

473 THALLIUM

476 TIN

507 VANADIUM

522 ZINC

FORM 2

LIST OF ALL ORDER AND LAB NUMBERS

FOR CLIENT: EPA

CURRENT DATE: 06/11/82

.2475	8206-0123	SAMPLE 1 METALS
.2475	8206-0124	SAMPLE 2 METALS
.2475	8206-0125	SAMPLE 1 ANION A
.2475	8206-0126	SAMPLE 1 ANION B
.2475	8206-0127	SAMPLE 1 ANION C

SCHEDULE OF TESTS DUE
WITH SPECIAL INSTRUCTIONS: ACID DIGESTION

DATE: 06/10/02

PAGE: 1

FILE NUMBER	ORDER NUMBER	LAD NUMBER	SAMPLE LOCATION	CLIENT NAME	DATE DUE	TEST NAME	CONTAINER TYPE	SAMPLE DESCRIPTION	PREP DATE
02-9505	.2462	0206-0089	0-0	THE COLEMAN COMPANY	06/23/02	ARSENIC	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0089	0-0	THE COLEMAN COMPANY	06/23/02	SELENIUM	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0089	0-0	THE COLEMAN COMPANY	06/23/02	SILVER	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0089	0-0	THE COLEMAN COMPANY	06/23/02	BARIUM	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0089	0-0	THE COLEMAN COMPANY	06/23/02	CADMIUM	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0089	0-0	THE COLEMAN COMPANY	06/23/02	CHROMIUM, TOTAL	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0089	0-0	THE COLEMAN COMPANY	06/23/02	LEAD	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0089	0-0	THE COLEMAN COMPANY	06/23/02	MERCURY	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0090	0-0	THE COLEMAN COMPANY	06/23/02	SILVER	1 GALLON JAR, LBN	PAINT SLUDGE 407-A	
02-9505	.2462	0206-0090	0-0	THE COLEMAN COMPANY	06/23/02	SELENIUM	1 GALLON JAR, LBN	COMPOSITE PAINT SLUDGE	
02-9505	.2462	0206-0090	0-0	THE COLEMAN COMPANY	06/23/02	CHROMIUM, TOTAL	1 GALLON JAR, LBN	COMPOSITE PAINT SLUDGE	
02-9505	.2462	0206-0090	0-0	THE COLEMAN COMPANY	06/23/02	CADMIUM	1 GALLON JAR, LBN	COMPOSITE PAINT SLUDGE	
02-9505	.2462	0206-0090	0-0	THE COLEMAN COMPANY	06/23/02	LEAD	1 GALLON JAR, LBN	COMPOSITE PAINT SLUDGE	
02-9505	.2462	0206-0090	0-0	THE COLEMAN COMPANY	06/23/02	BARIUM	1 GALLON JAR, LBN	COMPOSITE PAINT SLUDGE	
02-9505	.2462	0206-0090	0-0	THE COLEMAN COMPANY	06/23/02	ARSENIC	1 GALLON JAR, LBN	COMPOSITE PAINT SLUDGE	
02-9505	.2462	0206-0090	0-0	THE COLEMAN COMPANY	06/23/02	MERCURY	1 GALLON JAR, LBN	COMPOSITE PAINT SLUDGE	
02-9505	.2462	0206-0091	0-0	THE COLEMAN COMPANY	06/23/02	MERCURY	1 GALLON JAR, LBN	COMPOSITE PAINT SLUDGE	
02-9505	.2462	0206-0091	0-0	THE COLEMAN COMPANY	06/23/02	BARIUM	1 GALLON JAR, LBN	STRIPPER TANK SLUDGE	
02-9505	.2462	0206-0091	0-0	THE COLEMAN COMPANY	06/23/02	CADMIUM	1 GALLON JAR, LBN	STRIPPER TANK SLUDGE	
02-9505	.2462	0206-0091	0-0	THE COLEMAN COMPANY	06/23/02	LEAD	1 GALLON JAR, LBN	STRIPPER TANK SLUDGE	
02-9505	.2462	0206-0091	0-0	THE COLEMAN COMPANY	06/23/02	CHROMIUM, TOTAL	1 GALLON JAR, LBN	STRIPPER TANK SLUDGE	
02-9505	.2462	0206-0091	0-0	THE COLEMAN COMPANY	06/23/02	SELENIUM	1 GALLON JAR, LBN	STRIPPER TANK SLUDGE	
02-9505	.2462	0206-0091	0-0	THE COLEMAN COMPANY	06/23/02	SILVER	1 GALLON JAR, LBN	STRIPPER TANK SLUDGE	
02-9505	.2462	0206-0091	0-0	THE COLEMAN COMPANY	06/23/02	ARSENIC	1 GALLON JAR, LBN	STRIPPER TANK SLUDGE	
02-9505	.2462	0206-0092	0-0	THE COLEMAN COMPANY	06/23/02	SELENIUM	1 GALLON JAR, LBN	STRIPPER TANK SLUDGE	
02-9505	.2462	0206-0092	0-0	THE COLEMAN COMPANY	06/23/02	LEAD	1 GALLON JAR, LBN	PAINT SLUDGE 407-C	
02-9505	.2462	0206-0092	0-0	THE COLEMAN COMPANY	06/23/02	BARIUM	1 GALLON JAR, LBN	PAINT SLUDGE 407-C	
02-9505	.2462	0206-0092	0-0	THE COLEMAN COMPANY	06/23/02	MERCURY	1 GALLON JAR, LBN	PAINT SLUDGE 407-C	
02-9505	.2462	0206-0092	0-0	THE COLEMAN COMPANY	06/23/02	ARSENIC	1 GALLON JAR, LBN	PAINT SLUDGE 407-C	
02-9505	.2462	0206-0092	0-0	THE COLEMAN COMPANY	06/23/02	CHROMIUM, TOTAL	1 GALLON JAR, LBN	PAINT SLUDGE 407-C	
02-9505	.2462	0206-0092	0-0	THE COLEMAN COMPANY	06/23/02	SILVER	1 GALLON JAR, LBN	PAINT SLUDGE 407-C	
02-9505	.2462	0206-0092	0-0	THE COLEMAN COMPANY	06/23/02	CADMIUM	1 GALLON JAR, LBN	PAINT SLUDGE 407-C	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	ARSENIC	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	LEAD	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	SILVER	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	SODIUM	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	BARIUM	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	CADMIUM	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	CHROMIUM, TOTAL	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	SELENIUM	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01330	0-30	PHILLIPS PETROLEUM CO.	06/25/02	MERCURY	METAL CAN DKS	CHEMICAL POND LIQUID	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	CHROMIUM, TOTAL	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	CADMIUM	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	SODIUM	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	BARIUM	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	SILVER	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	ARSENIC	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	LEAD	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	SELENIUM	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9505	.2479	0206-01340	0-30	PHILLIPS PETROLEUM CO.	06/25/02	MERCURY	METAL CAN DKS	CHEMICAL POND SLUDGE	
02-9514	.2480	0206-01401	0-0	NOVA CORPORATION	06/14/02	CHROMIUM, TOTAL	PLASTIC LITER LBN	WELL 07A	

FORM 3

SCHEDULE OF TESTS DUE

DATE: 06/11/82

TEST: CANTON

(169)

PAGE: 1

LAB NUMBER	SAMPLE LOCATION	CONTAINER TYPE	CLIENT NAME	FILE NUMBER	SAMPLE DESCRIPTION	SPECIAL INSTRUCTIONS	PREP DATE	DUE DATE
0205-0403	SHELF 2	1 SMALL JAR, BKS	MONSANTO COMPANY	02-9505	1-HCGF-010-001	EP TOXICITY	06/07/82	06/14/82
0205-0404	SHELF 2	1 SMALL JAR, BKS	MONSANTO COMPANY	02-9505	1-HCGF-010-001	EP TOXICITY	06/07/82	06/14/82
0205-0405	SHELF 2	1 SMALL JAR, BKS	MONSANTO COMPANY	02-9505	1-HCGF-010-001	EP TOXICITY	06/07/82	06/14/82
0205-0406	SHELF 2	1 SMALL JAR, BKS	MONSANTO COMPANY	02-9505	1-HCGF-020-001	EP TOXICITY	06/07/82	06/14/82
0205-0002	4-2	SEE TAG, LBN	HERCULES INCORPORATED	02-9520	HW-01-54	GROUND H2O PARAMETERS PREP.	06/02/82	06/08/82
0206-0063	0-13	SEE TAG, LBN	HERCULES INCORPORATED	02-9520	HW-01-37	GROUND H2O PARAMETERS PREP.	06/02/82	06/14/82
0206-0089	4-4	1 GALLON JAR, LBN	THE COLEMAN COMPANY	02-9505	PAINT SLUDGE 007-A	ACID DIGESTION		06/23/82
0206-0090	4-4	1 GALLON JAR, LBN	THE COLEMAN COMPANY	02-9505	COMPOSITE PAINT SLUDGE	ACID DIGESTION		06/23/82
0206-0091	4-4	1 GALLON JAR, LBN	THE COLEMAN COMPANY	02-9505	STRIPPER TANK SLUDGE	ACID DIGESTION		06/23/82
0206-0092	4-4	1 GALLON JAR, LBN	THE COLEMAN COMPANY	02-9505	PAINT SLUDGE 007-C	ACID DIGESTION		06/23/82
0206-00990	4-2	1 SH PLASTIC, LBN	PLESSEY AERO PRECISION CO.	02-9505	SOLID	ACID DIGESTION	06/07/82	06/17/82
0206-01000	4-2	1 SH PLASTIC, LBN	PLESSEY AERO PRECISION CO.	02-9505	LIQUID	ACID DIGESTION	06/07/82	06/17/82
0205-0109	4-4	SEE TAG, LBN	HERCULES INCORPORATED	02-9520	HW-01-34	GROUND H2O PARAMETERS PREP.	06/04/82	06/11/82
0206-0111	4-50	1 CUB, LBN	HERCULES INCORPORATED	02-9529	WASTE WATER 20147	TOTAL RECOVERABLE	06/04/82	06/10/82
0206-0123	4-10	1 AMPULE, LBN	EPA	LAB CERT	SAMPLE 1 METALS	SEE WORKSHEET	06/04/82	06/10/82
0206-0124	4-10	1 AMPULE, LBN	EPA	LAB CERT	SAMPLE 2 METALS	SEE WORKSHEET	06/04/82	06/10/82
0206-01201	4-22	1 CUB	WATSON LABORATORIES	02-9501	SAMPLE GROUP 1	TOTAL RECOVERABLE	06/05/82	06/12/82
0206-01330	4-30	METAL CAN BKS	PHILLIPS PETROLEUM CO.	02-9505	CHEMICAL POND LIQUID	ACID DIGESTION	06/09/82	06/15/82
0206-01340	4-30	METAL CAN BKS	PHILLIPS PETROLEUM CO.	02-9505	CHEMICAL POND SLUDGE	ACID DIGESTION	06/09/82	06/15/82
0206-0142	4-49	SEE TAG, LBN	HERCULES INCORPORATED	02-9520	HW-01-00	GROUND H2O PARAMETERS PREP.	06/09/82	06/15/82
0206-0157	4-49	SEE TAG, LBN	HERCULES INCORPORATED	02-9520	HW-01-13	GROUND H2O PARAMETERS PREP.	06/10/82	06/15/82
0206-0250E	4-30	3 500 ML GLASS, LBN	PFIZER INC.	02-9505	SAMPLE 2	EP TOXICITY		06/21/82
0206-0259T	4-50	2 L 1 CUB 1 250 2 TOC LBN	LATHE--WESTERN CO. INC.	02-9516	GROUNDWATER	TOTAL RECOVERABLE		06/18/82
0206-0260T	4-50	1 GL L 2 CUB 1 250 PL RLN	WATSON LABORATORIES	02-9501	SAMPLE 2 BUILDING C	TOTAL RECOVERABLE	06/11/82	06/21/82
0206-0262	0-15	SEE TAG, LBN	HERCULES INCORPORATED	02-9520	HW-01-99	GROUND H2O PARAMETERS PREP.		06/17/82
0206-0273T	4-4	1 GL L 2 CUB 1 250 PL RLN	WATSON LABORATORIES	02-9501	SAMPLE 3 RLD	TOTAL RECOVERABLE		06/22/82
0206-0280T	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	CCO	TOTAL RECOVERABLE		06/24/82
0206-0281T	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	CCO	TOTAL RECOVERABLE		06/24/82
0206-0282J	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	OW-1	FILTERED IN FIELD		06/24/82
0206-0283J	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	OW-3	FILTERED IN FIELD		06/24/82
0206-0284J	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	OW-4	FILTERED IN FIELD		06/24/82
0206-0285J	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	OW-6	FILTERED IN FIELD		06/24/82
0206-0286J	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	OW-10	FILTERED IN FIELD		06/24/82
0206-0287J	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	OW-11	FILTERED IN FIELD		06/24/82
0206-0288J	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	OW-12	FILTERED IN FIELD		06/24/82
0206-0289J	4-11	2 CUB, BKS	WOODWARD-CLYDE CONSULTANTS	00-9530	OW-13	FILTERED IN FIELD		06/24/82

FORM 5

TEST RESULT CHECK FORM

PREPARER'S INITIALS: MLB

06/10/82

PAGE: 1

CODE NAME

LAB NO. RESULT UNITS

ANALYST BOOK/PAGE

387 PH

8206-0133

7.

BAT 166 /17

387 PH

8206-0134

9.

BAT 166 /17

387 PH

8206-0142

6.9

BAT 166 /17

387 PH

8206-0145

7.7

BAT 166 /17

387 PH

8206-0146

7.3

BAT 166 /17

387 PH

8206-0147

8.2

BAT 166 /17

387 PH

8206-0157

7.4

BAT 166 /18

387 PH

8206-0157X

7.4

BAT 166 /18

387 PH

8206-0157Y

7.4

BAT 166 /18

387 PH

8206-0157Z

7.4

BAT 166 /18

387 PH

8206-0248

7.0

BAT 166 /18

387 PH

8206-0253

8.2

BAT 166 /18

387 PH

8206-0255

7.8

BAT 166 /18

387 PH

8206-0256

8.9

BAT 166 /17

387 PH

8206-0257

7.5

BAT 166 /17

387 PH

8206-0260

11.2

BAT 166 /17

387 PH

8206-0261

7.8

BAT 166 /18

WILSON LABORATORIES

LABORATORY REPORT

PAGE 2

CLIENT:ABC INDUSTRIES

DATE RPTD.:02/05/82

ANALYSIS	CONCENTRATION	UNITS	ANALYST	BOOK/PAGE
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*****GROUP III PARAMETERS*****

ANALYZED 02/05/82

PH	7.0		JSB	108 / 62
PH	7.0		JSB	108 / 62
PH	7.0		JSB	108 / 62
PH	7.0		JSB	108 / 62
SPECIFIC CONDUCTANCE	980.	UMHOS/CM	JSB	108 / 62
SPECIFIC CONDUCTANCE	980.	UMHOS/CM	JSB	108 / 62
SPECIFIC CONDUCTANCE	980.	UMHOS/CM	JSB	108 / 62
SPECIFIC CONDUCTANCE	980.	UMHOS/CM	JSB	108 / 62
TOTAL ORGANIC CARBON	5.7	MG/L	JSB	108 / 62
TOTAL ORGANIC CARBON	5.7	MG/L	JSB	108 / 62
TOTAL ORGANIC CARBON	5.7	MG/L	JSB	108 / 62
TOTAL ORGANIC CARBON	5.7	MG/L	JSB	108 / 62
TOTAL ORGANIC HALOGEN	ND(1)	UG/L AS CL	JSB	108 / 62
TOTAL ORGANIC HALOGEN	ND(1)	UG/L AS CL	JSB	108 / 62
TOTAL ORGANIC HALOGEN	ND(1)	UG/L AS CL	JSB	108 / 62
TOTAL ORGANIC HALOGEN	ND(1)	UG/L AS CL	JSB	108 / 62

—CONCLUSION—LAB NUMBER: 8202-0000

ND(), WHERE NOTED, INDICATES NONE DETECTED WITH THE DETECTION LIMIT IN PARENTHESES

ANALYSES WERE PERFORMED ON SAMPLES AS RECEIVED BY WILSON LABS UTILIZING APPROVED PROCEDURES PUBLISHED IN THE FEDERAL REGISTER, VOL. 44, NO. 233, DEC. 3, 1979 (69568-69575) AND AS AMENDED IN THE FED. REG., VOL. 44, NO. 244, DEC. 18, 1979.

WILSON LABORATORIES

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SAMPLE REPORT
WILSON LABORATORIES

528 NORTH NINTH STREET - P.O. BOX 1858 - SALINA, KANSAS 67401 - (913)825-7186

LABORATORY REPORT

PAGE 1

CLIENT: ABC INDUSTRIES
ATTN: PURCHASING
P.O. BOX 549
NO STATE

DATE RPTD.: 02/05/82
DATE RCVD.: 02/05/82
PURCHASE AUTH: 15928
FILE NO.: 82-9500

ANALYSIS	CONCENTRATION	UNITS	ANALYST	BOOK/PAGE
<hr/>				
LAB NUMBER: 8202-0000	SAMPLE DESCRIPTION: GROUNDWATER MONITORING			
ORDER NUMBER: XXXX	SPECIAL INSTRUCTIONS: ANALYZED AS RECEIVED			
DATE SAMPLED: 02/02/82	TIME SAMPLED: 1800			
TEMPERATURE	18.	DEGREES C	BTF	161 / 000
*****GROUP IA PARAMETERS*****				
ANALYZED 02/05/82				
ARSENIC	0.003	MG/L	BTF	161 / 000
BARIUM	0.31	MG/L	BTF	161 / 000
CADMIUM	0.0022	MG/L	BTF	161 / 000
CHROMIUM, TOTAL	0.032	MG/L	BTF	161 / 000
FLUORIDE	0.21	MG/L	JSB	108 / 62
LEAD	0.019	MG/L	BTF	161 / 000
MERCURY	ND(0.0002)	MG/L	BTF	161 / 000
NITRATE	ND(0.1)	MG/L AS N	JSB	108 / 62
SELENIUM	ND(0.002)	MG/L	BTF	161 / 000
SILVER	ND(0.0005)	MG/L	BTF	161 / 000
TURBIDITY	2.	NTU	CAS	85 / 23
TOTAL COLIFORM	ND(1)	COLONIES/100 ML	JSB	108 / 62
ENDRIN	ND(0.0001)	UG/L	CJB	150 / 555
LINDANE	ND(0.001)	UG/L	CJB	150 / 555
METHOXYCHLOR	ND(0.05)	UG/L	CJB	150 / 555
TOXAPHENE	ND(0.005)	UG/L	CJB	150 / 555
2,4-D	ND(0.01)	UG/L	CJB	150 / 555
2,4,5-TP	ND(0.001)	UG/L	CJB	150 / 555
*****GROUP IB PARAMETERS*****				
ANALYZED 02/05/82				
ALPHA, TOTAL	5.	PCI/L	BKS	189 / 001
BETA, TOTAL	5.	PCI/L	BKS	189 / 001
RADIUM, TOTAL	1.6	PCI/L	BKS	189 / 001
*****GROUP II PARAMETERS*****				
ANALYZED 02/05/82				
CHLORIDE	36.	MG/L	JSB	108 / 62
IRON, TOTAL	17.0	MG/L	BTF	161 / 000
MANGANESE	1.53	MG/L	BTF	161 / 000
PHENOLIC COMPOUNDS	ND(0.005)	MG/L	JSB	108 / 62
SODIUM	47.	MG/L	BTF	161 / 000
SULFATE	90.	MG/L	JSB	108 / 62